FOOD MANUFACTURE

PUBLISHED BY LEONARD HILL LIMITED, 17, STRATFORD PLACE, W.1 OCTOBER, 19

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FOOD MANUFACTURE

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Volume . . . XI
Number . . . 10

OCTOBER . . . 1936

Dairy Products Number

SUBSCRIPTION

Single Copies - 1/-
Annual Subscription
12 Issues - - 10/-
Foreign - - 12/6

Published on the first day of the Month by
LEONARD HILL LIMITED
17, Stratford Place, London, W.1
Telephone: Mayfair 7383
(Private Branch Exchange).

Managing Editor:
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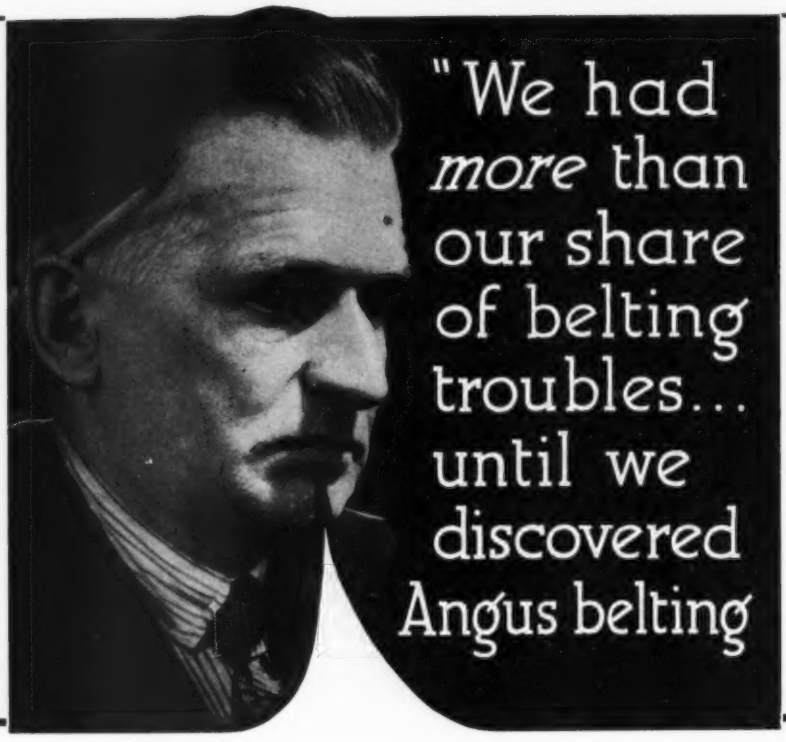
The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible

CONTENTS

PAGE

Editor's Comments *by G. W. Lacey, B.Sc., A.I.C.* . 343
The Nutritive Value of Milk 347
Milk Concentrates. I. Modern Condensed Milk Manufacture *by Dr. C. Knoch* . . . 349
A German Milk Pasteurising Plant . . . 355
Analytical Methods Applied to Cereal Products (Part II) *by T. H. Fairbrother, M.Sc., F.I.C.* 356
Still Fresh after Five Months *by Dr. A. van Raalte* 359
Malted Milk *by H. Silman, B.Sc., A.I.C.* . . . 360
Carotene *by H. Stanley Redgrove, B.Sc., F.I.C.* . . 364
Book Reviews 367
Industrial News 368
The Methylene Blue Reduction Test in the Control of Milk Supplies *by Ralph G. Harry, A.I.C., A.C.I.C., F.R.M.S.* 372
The Bakers' Exhibition, 1936 *by E. B. Bennion, M.Sc., A.I.C.* 374
Information and Advice 376
New Companies 378
Recent Patents 379
Latest Trade Marks 380



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Vol. XI, No. 10 October, 1936

The Advancement of Food Science

EVER SINCE the British Association for the Advancement of Science held its meetings importance has been attached to the discussion of subjects connected with food. This is indeed as it should be, and there is every reason why still greater prominence should be given to the advancement of this particular branch of science. The British Association is a philosophical body holding an annual meeting which enjoys considerable publicity. The contributions of some of our greatest workers to the different discussions are read by millions. It is interesting to contrast the wide field of subjects covered to-day with those of a hundred years ago. It was Sydney Smith who, writing to a friend in 1836, made the following remarks about a meeting of the Association held at Bristol: "Their occupations appear to be of the greatest importance. On Monday they dissected a frog. On Tuesday they galvanised a goose" (presumably into action!). "On Friday a new and philosophical mode of making butter was brought forward, and several pats of butter exhibited. On Saturday they all set off on the outside of coaches, believing they had conferred the utmost benefits on the human race." "You and I know better", he concluded. But did they?

* * *

This year, in the absence of Sir Frank Smith, Dr. Lampitt introduced the subject, which was "Chemistry and Food Science". He pointed out that mankind had been stimulated into seeking the help of science in connection with food production by the fear of world shortage and of war, by national economics, commercial competition, and, lastly, by the desire to research into the unknown. That is a great tribute to food science. And it is, we believe, the advancement of that science and its application to problems of production, manufacture, and distribution all over the world that will overcome those very fears and difficulties. There were papers by Dr. L. J. Harris of the Dunn Nutritional Laboratory at Cambridge, who dealt with the nutritional aspect, by Dr. Franklyn Kidd of the Low Temperature Research Station on the biology of food (read by Dr. T. Moran), and by Mr. T. Herbert of the London, Midland and Scottish Railway Company, who spoke on food transport.

* * *

Whilst these contributions were all peculiarly relevant to present-day problems, we think that next year's discussions should bring out points still more closely connecting food science with the fulfilment of the most urgent human requirements. Sir Josiah Stamp, President of the Association, took part in the discussion and criticised popular literature on nutrition and malnutrition, and even the scientific side, because it contains, he said, statistical ambiguities and dubieties. Obviously what is required is closer co-operation between scientist and economist in interpreting the results of scientific research in the light of economic conditions. The broad social implications of a national food policy based upon the scientific discoveries of the last decade are already self-evident. All that remains is to implement such a policy with all speed and to push on with the advancement of this science. "The utmost benefits", as Sydney Smith put it, have not yet been conferred on the human race.

Agricultural Economy

We have on many occasions expressed our views about the economic utilisation of our agrarian land and have spoken in no uncertain terms about the unsound policy of wheat and beet production beyond certain low limits. The Government seem determined to go on with their misguided policy of subsidising uneconomic production, but it is pleasing to hear more and more voices crying in the wilderness, in protest against the present policy. Sir John Orr and others at the British Association meetings have again referred to the folly of wheat

and beet and the urgent need for the more perishable foodstuffs. Let it not be thought that our views on the subject of wheat are at variance with our statements on food reserves in the country. We believe in a sufficient surplus of stored grain in this country and we are convinced that it could be stored without damage or danger. We are not declaiming against adequate stocks of wheat; we are protesting against a large home production of an uneconomic crop when the land could be turned to better advantage. At the recent International Conference of Agricultural Economists Mr. F. L. McDougall said that, although there was something to be commended in the policies of European countries aiming at national self-sufficiency, there was a perfectly sound alternative in maintaining a contented peasantry by protecting the more perishable agrarian commodities, such as fresh eggs, vegetables, fresh fruit, and milk. They could leave wheat and sugar to the countries where they were produced at much lower cost. It is evident that thinking men and women now feel that the Government's present agricultural policy is economically unsound. If they tried a little more thinking perhaps the Government might think so too.

The Wrong Perspective

It is becoming increasingly evident that the Government's agricultural policy is entirely out of perspective, and the state of the various boards is now most disgustingly chaotic. After years of philandering the Government have produced nothing but confusion and dissatisfaction among all branches of agriculture, with the possible exception of the wheat and beet producing minority that have been spoon fed into quiescence. The pig producers are in open revolt and are refusing to make the contracts requisite to keep the bacon factories going. Milk producers are furious at the award of the Committee of Investigation accepted by the Minister of Agriculture in regard to the wholesale price of milk. As a result of the necessary adjustment the pool prices for the last quarter of this year are miserably low, and many producers will suffer serious losses. The Government must realise that agriculture should be regarded as a whole, instead of a lot of separate interests locked up in watertight compartments. The problems of meat and milk are intimately linked together. The size of fat stock herds has a definite relationship with the amount of milk produced. In Denmark it is recognised that the high standard of Danish bacon is due to the widespread use of milk in pig feeding. Thus the pigs and milk boards should be linked up, and it might be far more profitable *nationally* for a lot of the surplus milk to be poured down the throats of potential bacon pigs than down the sinks of cheese factories. If anything is to be done to assist home agriculture a broad vista must be taken of farming as a whole and not distorted views of individual sections.

Will the Pigs Marketing Scheme Survive?

Of all the Government's efforts to ameliorate home agriculture probably the most ghastly failure is the Pigs Marketing Scheme. We have seen how the pigs and bacon industries have been reduced to a state of chaos. Foreign producers have benefited handsomely, and home producers are worse off than ever. Pig farmers are so disgusted with the scheme that they are gradually breaking away, and the bacon factories have not got anything like enough pigs to keep up an efficient supply throughout. Recently a number of amendments to the Pigs Marketing Act have been passed by a very small poll of producers—the vast majority being too disgusted with things in general to bother to vote. The "equitable distribution" clause is, however, coming in for a good deal of criticism. In spite of a stout defence of the scheme as a whole by Mr. Fox (chairman of the Pigs Board) and the fact that they had at first decided to support the 1937 pigs contract, the majority of farmers in Yorkshire are now joined in open protest. The situation is rather ridiculous. There is a factory at Norton and yet many Yorkshire pigs have to be sent to the South of England to be cured, simply because the Norton factory is only given a quota of 18,000 pigs. The Yorkshire farmers' stand has been made in face of the plea by the chairman of the board that they were concerned in a national scheme and not one for a section of the community. His warnings were significant, and he said that as things were shaping at present the scheme is in serious jeopardy. We agree entirely and think that the sooner the whole thing is scrapped the better it will be for all concerned.

The Harvest

Last month we asked the question, "What will the harvest be?" and indulged in a little gloomy prognostication as to the effect of the wet, sunless summer on the wheat crop. We are now in a better position to make definite statements as the best or worst is now known. The fine harvest

weather of August was a godsend in many parts and did much to stave off an absolute failure and in many districts most of the corn has been carried in good order. On the whole, however, it is quite evident that wheat has not yielded well. A Sussex farmer, writing to *The Times*, said, "Wheat is a most disappointing crop owing to blight, yields of six sacks to the acre are more common than eight sacks. Spring wheats are usually better than winter sown". This experience of the Sussex farmer is, we fear, fairly general. In Oxfordshire it is stated that the wheat crop is the worst for a generation. In general, all along the south coast, from Dungeness to Land's End, wheat is poor in yield and mediocre in quality. It will make bread of sorts, but, as the Scotsman said, "only just". We understand that the quality is somewhat better in East Anglia, but the yields are very poor —two or three sacks to the acre less than last year. The unfavourable conditions to which the wheat plant has been subjected may well be reflected in next season's seed grain, and next year's crop may be influenced as well as this.

Honey

In our August issue we commented on the state of the honey industry and we advised producers to refrain from hurrying the current year's production into an unwilling market in August and September, but to wait a while. We said then that the prospects for a big production this year were not good. It appears as if the surplus about which beekeepers were afraid will be really necessary as supplies are very poor. The British Beekeepers' Association have just held their autumn show after a heart-breaking season—it has been said the worst in thirty years. The bee is a fine weather worker, and will never bestir himself if the sun is not shining. Man has studied their habits, tamed their spirits, conquered their stings, but so far has not instilled into them a capacity for foraging in the rain. It is paradoxical that the abundantly wet summer has resulted in enormous crops of clover, and yet the very rain that has encouraged the clover has kept the bees at home. We hear that some keepers have not gathered more than one-tenth of their normal harvest. Probably the only hope left is for those whose swarms have access to heather. There is some controversy regarding the merits of heather honey gathered in Scotland and England. The Scots maintain that bell heather honey is superior to all others. This shrub thrives in Scotland, North Wales, and Southern England. In the Midlands the honey is gathered from the ling, and as the honey from the Midlands usually takes first prizes, even in Scotland, the Scottish claim about bell heather may be more patriotic than correct. One authority states that the heather of the Midlands produces the finest heather honey in the world.

The Bakers' Exhibition

Exhibitions throughout the year are like hours of the day, they come round so quickly that we hardly seem to have passed one before the same one comes round again. But that is no justification for an exhibition showing little or no outward change in its arrangements of the display of its stands from year to year. We were particularly struck by this sameness when we visited the Bakers' Exhibition last month. After walking up and down one or two aisles to get a preliminary view we had to blink our eyes and make enquiries at a few of the stands to be quite sure this was the 1936 Exhibition. Of course, we were very pleased to see so many of the same people we saw last year and to hear about their new developments and products. But the fact to which we are drawing attention cannot give an impression of progressiveness to those visitors who come to the Exhibition because it is *the* Exhibition of their trade. It is perhaps very convenient for exhibitors to have their stands in the same place. They are easily found. But the sight of so many stands looking much the same if not identical with last year's stands does not give a good impression. Some rearrangement could be done for the better, too.

* * *

There was overcrowding in the galleries and empty spaces in the Gilbey Hall. Why not put all competitive classes together in the Gilbey Hall and not mix them up with stands and exhibits in the gallery? The catering in all parts of the hall, which ought to include the most delicious representation of bread and confectionery making that could be achieved, left much to be desired in this respect. Why doesn't someone offer a prize for an entirely new form of cake to liven up the competitions? We really feel that organisers and exhibitors as a whole ought to show more enterprise from year to year. A report on the exhibits will be found on page 374 and a full review was published in *Food Industries Weekly* on September 11 and September 18.

Milk Sterilisation by Oligo-Dynamic Silver

The sterilising action of small amounts of metals like copper and silver has been known for a considerable time, but has hitherto found practical application only in the realm of water purification. Metallic copper and silver possess a somewhat mysterious property known as "oligo-dynamic" action whereby their presence in polluted water brings about the destruction of micro-organisms, the metals themselves being to all intents and purposes unchanged in the process. This may be likened to a catalytic effect. Copper, for instance, is stated to be oligo-dynamic, for, according to Kraemer, when a 3½-inch sheet (square) is placed in water, a quart will be purified in 6 hours of all bacterial life, including organisms such as *B. coli* and *B. typhosus*. The advisability of using metallic copper for treating drinking water may quite rightly be questioned, but dissolved copper salts actually are used in practice for destroying unwanted vegetable growths and algæ in reservoirs. Silver appears to be more oligo-dynamically active than copper, and for many practical reasons is preferable. Brandes (*Ind. and Eng. Chem.*, 1934, page 962), who made a detailed study of this metal from the oligo-dynamic standpoint, found that the presence of 0·05 parts per million of this element in water was sufficient to kill all bacteria in an hour. The German workers, Egg and Jung, found that a concentration of 0·04 milligram of silver per litre of water effectively destroyed cultures of *B. coli*. Higher concentrations of copper were necessary to bring about the same destruction.

* * *

In practice, for treating water, a silvered sand is used—that is, sand whose individual particles are coated with a thin film of metallic silver. After traversing a bed of such material, polluted water is free from living micro-organisms and bacteria, although no change is brought about in the mineral content and the usual organic constituents. It would seem reasonable to assume also that taste and odour are unchanged by oligo-dynamic treatment except in so far as removal of active organisms brought about their elimination. Considering the neatness and convenience of the oligo-dynamic process for drinking water purification, it is a little strange that its application to the treatment of other liquid products for human consumption has not been attempted sooner. It appears from the recent literature, however, that milk may be sterilised by contact with silvered clay pellets at a temperature of 63° C. U.S. Patent No. 2,028,072 of the Katadyn Inc. of America gives some details of its application. Milk previously heated to the above temperature is treated with the pellets for a short time but not sufficiently long to cause complete sterilisation or to impart a boiled taste. Colour and odour changes are prevented by limiting the time of exposure, whilst the full vitamin content is substantially conserved. There would appear to be other spheres of usefulness for oligo-dynamic metals—for example, in the treatment of wines and beverages. At present the available data from such fields is very small, but there is sufficient evidence to indicate interesting possibilities for the future.

Pickled Vegetables

In our Editorial Comments for August last year we devoted a paragraph to the question of brining vegetables and suggested that there ought to be a big increase in the consumption of home-grown vegetables in the brining industry. This would be of considerable assistance to the land settlement problem. It is rather astonishing to learn that we import nearly 95 per cent. of the onions consumed in this country. In this connection we would draw attention to an interesting article by Mr. H. V. Taylor on "Vegetables for Pickling" in a recent issue of the *Journal of the Royal Horticultural Society*. He refers to the fact that while we eat enormous quantities of gherkins it is almost impossible to buy one grown in this country. We import over 1,000 tons of fresh gherkins and 2,000 tons in brine. We feel that this production could well be undertaken in England. If we can grow cucumbers there seems no reason why we should have to import gherkins.

* * *

Mr. Taylor informs us about the demand for pickled onions. In the South of England the demand is for onions which turn brown on pickling. In the North only pure white onions are appreciated. The bulk of the pickling onion growing is done in Holland. There is no reason why the Pearl type of onion should not be cultivated in England. Red cabbage is another pickling vegetable that could receive more attention. We have land idle and people unemployed and yet we import 1,938 tons of red cabbages, which are the easiest things to grow. The same thing applies to cauliflowers—last year 119,000 cwt. were imported from Italy or Holland. This is a very important matter. Pickles have become a standard article of diet and require specially cultivated vegetables. We ought to grow them and not import them. What about some of our pickle manufacturers imitating some of our more progressive canners and jam makers?

The NUTRITIVE VALUE of MILK

MILK, THE final source of nourishment between mother and baby, contains a vast number of nutritional factors essential for the life and development of the child. Its complexity is evidenced by the fact that for some months it must act as a "complete" source of food.

The following mean figures show the relative proportions of the main constituents in milk from different sources:

	Cow.	*Human.*	*Goat.*	*Ewe.*	*Mare.*	*Ass.*
Specific gravity ...	1·0315	1·03	1·0305	1·0341	1·0347	1·036
Water % ...	87·27	87·41	85·71	80·82	90·78	89·64
Casein % ...	3·02	1·03	3·20	4·97	1·24	0·67
Albumin %...	0·53	1·26	1·09	1·55	0·75	1·55
Fat % ...	3·64	3·78	4·78	6·86	1·21	1·64
Lactose % ...	4·88	6·21	4·46	4·91	5·67	5·99
Ash % ...	0·71	0·31	0·76	0·89	0·35	0·51

These figures, however, give no idea of the actual complexity. In the following grouping, in which only the main elements of nutritive value are stressed, some of the more complex compounds are noted.

The Proteins of Milk

Milk contains the proteins casein, lactalbumin, lactglobulin, and an alcohol soluble protein discovered by Osborne and Wakeman in 1918. These in turn represent a large number of amino-acids, for detailed information of which a monograph on milk should be consulted.

Casein, the most important one, is a phospho-protein whose composition and properties resemble closely "vitellin", which occurs in hen's egg, and it is present in cow's milk to the extent of 2·5 to 3 per cent., whilst lactalbumin, the principal constituent of whey (milk serum), comprises about 0·5 per cent.

These two proteins, comprising about 93 per cent. of the total milk proteins, *are biologically complete—i.e.*, either given in sufficient quantity in conjunction with an otherwise adequate diet will support satisfactory growth and reproduction. Rose and McLeod have demonstrated that the nitrogen of milk is more efficiently utilised by the human body than the nitrogen of other foods.

Of particular importance is the fact that milk proteins act as a valuable supplement to those of cereal sources, and experiments have demonstrated that the deficiencies of amino-acids in maize proteins, etc., can be supplemented by the excess of those occurring in milk. Since the human dietary consists of over 60 per cent. milled cereals, this is invaluable in utilising the inferior proteins of cereals, whilst at the same time it confers its own nutritive value in addition.

A human fœtus about 8 weeks of age. Apart from the large head, the most striking feature is the rapid ossification, and the well-formed deposits of bone can be seen clearly. This is a very striking example of the necessity for an adequate calcium intake, even from the earliest beginning of pregnancy, and milk is the most important source of this element.

The Carbohydrates

Lactose plays a peculiar part in the human diet, as in some unique manner it increases the adsorption of calcium and phosphorus from the gut and assists in their retention in the body. The importance of these is discussed under "Mineral Salts".

In fact, the influence of lactose in ensuring correct deposition on inorganic salts in bone may be as great as that of vitamin D.

The human lactose content of human milk has been advanced as an explanation of the diminished incidence and severity of rickets in babies reared on this, as against cow's milk, although this latter is richer in calcium and phosphate. Further, sufficient quantities of lactose, in addition to their slightly laxative action, produce in the intestine a medium favourable for the growth of non-putrefactive organisms—*e.g., Bacillus avidophilus*. The study of such flora is receiving a considerable amount of attention.

Milk Fat

The fat of milk consists of the mixed glyceryl esters of the following fatty acids: Butyric, caproic, capryllic, capric, lauric, myristic, palmitic, stearic, arachidic, oleic and linoleic and dihydroxystearic, together with small quantities of lecithin and cephalin, carotene and carotinoids, cholesterol and ergosterol. It is of exceptional composition in that it is rich in acids of lower molecular weight, which are readily broken down for energy purposes because of their solubility and reactivity.

In this connection Hilditch's recent researches on fats are invaluable. Until quite recently it was assumed that one type of vegetable fat was as good as another. This is now known to be quite wrong. Fats may have the same average values for such constants as their mole-

cular weight of the fatty acids and their degree of unsaturation and yet be composed of quite different glycerides, having quite different physiological values. The assumption, therefore, that *a margarine with added vitamins may be dietetically equal to butter requires considerable modification, and in many cases is incorrect.*

The Mineral Salts in Milk

These supply an essential part of the diet for the building up of the human frame, for the general development of the soft organs and tissue of the body and the maintenance of the correct *p*H of the body fluids.

Milk is undoubtedly the best source of dietary calcium, all the other foods with the exception of green leafy vegetables being poor sources of this element. Further, it has been shown that more calcium is retained by the body when fed on milk than when an equal amount of green material is provided. In fact, babies reared on cow's milk are considered to absorb and retain more calcium and phosphorus than do those reared on human milk. (Care must be taken in interpreting this, since lactose has been shown to have a special "mobilising" effect which may counteract the loss of these in human milk.) Sherman and Hawley (*J. Biol. Chem.*, 1922, 53, 375) have shown that the optimum storage is made when the daily diet of a child contains at least 2 pints of milk.

It is not generally realised that the pregnant mother, especially during the last few months, requires large quantities of calcium in her diet in order to supply her rapidly developing fœtus with all its needs without sacrificing her own invaluable store. *Minor deficiencies of calcium are now believed to be definitely related to some of the common disorders associated with motherhood.* In addition to being a probable cause of dental caries and painful muscular cramp (which are common features connected with motherhood) *evidence is accumulating to show that some of the toxæmias of pregnancy may be prevented by increasing the supply of calcium and vitamin D.* The simplest way of ensuring an adequate supply of calcium is to utilise the naturally rich source of calcium —*milk.*

The Vitamins Supplied by Milk

Milk contains all the vitamins necessary for man, but, with the exception of vitamin A, is not a rich source of them. Therefore milk should be supplemented by a carefully chosen and well-mixed diet.

Vitamin A.—The fat-soluble, anti-xerophthalmic vitamin, essential for normal growth and reproduction and for the maintenance of health and vigour of the body. Makes the body more resistant to certain types of bacterial infection, especially of the respiratory organs, skin and digestive organs.

Xerophthalmia is a characteristic eye disease developing in absence of adequate supplies of vitamin A. All Danish butter was exported during the early part of the Great War and families lived on margarine. During this time many cases of this disease were reported, which, however, disappeared on the ceasing of hostilities.

Vitamin D.—Anti-rachitic vitamin, essential for the proper laying down of the calcium salts and preventing rickets. Milk rarely contains sufficient of this vitamin to prevent or cure rickets in babies. This is, however, also absent from human milk. In such cases the diet should be extended to include cod liver oil during the winter season and exposure to sunlight during the warmer months. The vitamin D of cow's milk, however, may be increased by feeding them on cod liver oil or irradiated yeast or by ultra-violet irradiation.

Vitamin E.—This fat-soluble, anti-sterility vitamin is completely removed in the cream and is therefore absent from skim milk. Although necessary for reproduction in rats, its necessity for human reproduction is not completely proved.

Vitamin B Complex.—This group has been divided into a number of sub-factors—viz., vitamins B_1, B_2, B_3, B_4, B_5. Only B_1, the heat-labile, anti-neuritic factor, and B_2, the heat-stable, pellagra-preventive, vitamins are of importance in milk. Since they are water-soluble they are present in skim milk.

Vitamin C.—The anti-scorbutic vitamin, specifically prevents scurvy and encourages sound development of the teeth. All milk, even when fresh, is a poor source of this vitamin, which, however, is readily obtained from other sources—*e.g.*, vegetables and fruit.

The Place of Milk in the Diet

Milk is rich in protein, fat, carbohydrate and inorganic salts. Its proteins are unique in that not only are they of superior value when used alone but are further specially adapted to supplement the deficiencies of protein in the cereals, which form the greater proportion of mankind's diet. Scientific investigation has shown that milk plays a unique rôle in human diet, especially in the case of babies and the expectant mother.

Milk, combined with other natural foods in adequate supply, will increase physical and mental development to an extent out of all proportion to its cost, but it is not a perfect food when used alone, and its extensive use amongst older children and adults without a sufficiency of other natural foods results in "nutritional anæmia". The conclusions reached after numerous investigations are that milk is deficient in iron and copper, both of which are essential in small quantities if health is to be maintained. There is reason to believe that these are not the only metals required, and the addition of manganese is also of importance.

When these are supplied, even in very small amounts, a milk diet allows the human body to function normally.

(*Continued on page* 363.)

MILK CONCENTRATES

I. Modern Condensed Milk Manufacture

By Dr. C. Knoch (of Rohr, Stuttgart)

Ever since the preserved milk industry in a primitive form was founded some hundred years ago, the industry has steadily grown in importance and has now reached an enviable stage of prosperity, thanks to the co-operation of the dairy farmer, chemist, and engineer. Considerable ingenuity has been exercised in overcoming the problems presented by the nature of cow's milk as a highly complex and perishable substance. This article, which is the first of a series of three, gives an exceptionally comprehensive picture of the industry. Advice is given on the most satisfactory plant constructional material in the light of the most recent researches and on the control of quality in each of the three important subdivisions—condensed milk, evaporated milk and dried milk.

AT ALL times cow's milk has formed the principal and most valuable ingredient for building up the human body, but its use for nutritional purposes has been limited to a narrowly circumscribed area around the place of production owing to the high water content and the speed of decomposition which prevented its transport to distant milk-poor areas. Attempts to improve the stability of milk and to facilitate transport were made even in hoary antiquity. No substantial progress was achieved, however, until science and technology had applied to this highly complex substance methods analogous to those used for preserving the simpler foodstuffs.

Early Developments

Probably the first man to turn his attention to milk preservation while experimenting with the stabilisation of perishable foodstuffs by cooking was the Frenchman, Appert, over 100 years ago. Yet satisfactory as the "Appert process" has proved down to the present day in connection with many vegetables, fruits, sacchariferous substances, etc., it could only be applied to milk with any measure of success in the presence of considerable proportions of ingredients other than milk, such as egg yolk and sugar. Hence the failure of the Appert process to be technically exploited for milk preservation, leaving out of consideration its subsequent modification for sterilisation of pure milk (free from adjuvants) in bottles and tins which was first elaborated in Holland by the author for bulk supplies (for ships) and by Soxhlet for children's milk cakes. Certain technical defects, notably intensification of transport difficulties, retarded introduction of sterilised milk and branded it to some extent as a medicinal article. At a much earlier date attempts had been made to alleviate the transport difficulty and simultaneously to increase the keeping quality by partial removal of water, the water being either evaporated by prolonged boiling or removed by freezing. The latter method could not be industrially exploited owing to the cost and probably did not get very much further than the laboratory experimental stage.

More progress was made by the evaporating method, for milk evaporation in the presence of sugar was patented in England as far back as 1835 by Newton, and in 1845 in America by Professor Ebenezer Norton Horsford, and in 1856 by Gail Borden. The latter's method was selected for industrial exploitation in 1866 by the Anglo-Swiss Condensed Milk Company in Switzerland, and has since been utilised all over the world.

Concentration of milk without any additional ingredients and solely by water evaporation, was not achieved by the industry until the turn of the century. By that time it was possible to apply the experiences gained in factory sterilisation of liquid raw milk to so-called evaporated milk (which had been concentrated to one-half its volume) to which the requisite keeping qualities, in association with reduced weight and volume in *closed containers*, was imparted.

Long before "evaporated milk" became established efforts were made (as numerous patents bear witness) to produce an even more easily transported dry product by *complete* removal of the water content of milk, subsequent addition of the original amount of water reproducing all the natural characteristics of the milk. Encouragement in these efforts was imparted by Grimwade's English patent of 1855 in connection with "milk powder," where-

by the raw milk was evaporated to paste consistency at normal pressure (subsequently in vacuum) in presence of neutralising substances, the paste rolled out to thin sheets which were dried completely in hot air, the "vermicelli"-like strips being finally powdered and sieved. That a powder reconvertible into fresh milk could never be obtained by this method (apart from the high alkali content) is to-day evident to the expert. In a more perfected form, the method is nevertheless still used in several American factories to prepare so-called "milk flour" for bakery purposes.

The Main Problems

This brief account of attempts to make milk concentrates and their development to the industrial stage clearly makes two points conspicuous:

1. The problem of milk concentration is fraught with high significance for the whole world.

2. Solution of the problem for all three concentrates (sweetened, evaporated-condensed and dried milk) can *only apparently* be achieved on the same lines. In practice, entirely dissimilar methods are needed to reach the various objectives. The products are not in the nature of three milk concentrates of different strengths obtainable by the same procedure and having identical fields of application. On the contrary, the properties of each are different and influence production and application in a different way.

World Production Data

Careful estimates based upon earlier statistics point to a total world production of about 158·5 million tons milk products in 1926, of which about 3·5 million tons—*i.e.*, 2·2 per cent.—were worked up to preserved milk. Taking into account the generally marked expansion of the world milk industry during the past decade, the proportion diverted to canning at the present day may reasonably be estimated at 2·5 per cent. or about 4 million tons per annum. In the absence of detailed statistics nothing is known about the quantity used for each type of concentrate. According to *Hunziker*, the American production of sweetened and evaporated milk in 1924 totalled about 850,000 tons as compared with a figure of only 39,000 tons for dried milk, or 4·6 per cent. of the former. Now the quantities of raw milk necessary to produce one part of each product are respectively:

Evaporated milk	.. .. ..	2½–3
Sweetened condensed milk	.. ..	3–4
Dried milk	.. .. approx.	9–12

Manufacture of dried milk thus calls for about three times as much raw milk as does that of the other two concentrates. In 1924 the United States production of dried milk accounted for 14 per cent. of the weight of raw milk consumed by the two remaining concentrates. Assuming a similar distribution in all other milk-processing countries in that year, it must be obvious to all who have studied the development of the concentrated milk industry that consumption of raw milk for desiccating purposes has very considerably exceeded the above-mentioned percentage in the course of the past decade.

If the milk concentrating industry, started on a modest scale some 70 years ago, now absorbs 2½ per cent. of the world's milk production and has also formed an immense stimulus to milk production itself, the main factor probably responsible for its expansion is the ease of transport of concentrated milk as compared with that of liquid milk. And the near future should witness still greater expansion as a result of technical improvements and the conquest of other markets should follow as a matter of course. It seems certain that concentrated milk will conquer the world market as soon as the desired maximum degree of nutritional efficiency can be guaranteed on the technical scale. For the advantage of conversion into concentrate is very marked even when quite short distances are involved owing to the saving on packing and freight.

Field of application and class of consumer are by no means identical for the three concentrates. Even though the fundamentals of manufacture and handling methods are similar in each case, technique and equipment will differ in certain details. Improvements in specific properties of individual concentrates are only attainable after equipment in general and methods have been modified in those very details leading to the properties in question. Consequently, in respect of each concentrate the process in common use should form the starting point for investigation into the possibility of achieving improvement in quality and thereby increasing consumption.

I. MODERN CONDENSED MILK MANUFACTURE

For our present purpose "condensed milk" will be understood—as is the case in most countries—to be a sugared, evaporated milk (full or skim), while milk concentrated in the absence of sugar will be merely described as "evaporated milk". These terms are in accord with current usage on the world milk market. We consider the term "dried milk" to be more suitable for the completely desiccated industrial product than "milk powder", because the powder form is liable to be displaced at any time by a more remunerative physical form (granules, dice, etc.).

Plant and Process

In simple form the layout of a modern condensed milk plant is as follows:

After the milk has been tested on the reception platform for general fitness, purity, freedom from dirt and freshness (acidity) and the weight recorded, it is run into the reservoir in order to give a mixture with maximum uniformity, through a fine-mesh filter retaining coarse impurities. From the reservoir it is transferred by gravity where possible, but otherwise by means of a pump, in succession through the heater, the clarifying separator and the mixing tank. The use of pumps for milk transport is avoided as far as possible in modern factories because, apart from the generally unavoidable enlargement of the fat particles after compression in the

body of the pump, they facilitate to an astonishing degree the incorporation and distribution of any bacteria or yeast strains that may be present in the total batch of milk.

Simultaneously the weighed quantity of sugar which has been converted into a clear, viscous syrup in the kettle is run into the mixing vessel at the same time as the milk and at the same temperature. The finished sugar-milk mixture now needs to be deprived of about three-quarters of its water content in the condensing plant, whereupon the inspissated syrup is systematically cooled in the cooling and crystallising plant in which microcrystals of sugar are formed. Filling of the condensed product into tins, airtight sealing by soldering the inlet opening or by soldering the lid on are then effected by a suitable machine. The tins are then ready for storage. Immediately before packing for despatch it is customary to test the tins, which may also have been chilled for some time in storage, for internal gas development in the apparatus which detects faults by checking the dimensions. Tins may then be labelled, wrapped and packed as desired.

Good Commercial Qualities

From the foregoing general description, the entire manufacturing process will appear to have changed but little in principle since the primitive commencement 70 years ago. Yet, particularly in the past two decades, science and technology have evolved many means and devices for improving quality and guaranteeing its uniformity. The process is now independent to a maximum extent of the skill and care of the workers as well as being capable of allowing for fluctuations in the quality of raw material batches. Indeed, scarcely any other product of the canning industry demands for its manufacture the observance of so many details, some of which are apparently insignificant but yet involve "finesse" if the consumer is to receive consistent satisfaction. Difficulties of manufacture are further increased considerably by the nature of milk as a "living" product, extremely changeable in biological properties, certain qualities of which are required to be transferred to the canned product and there retained until resuscitated on reconversion into the original liquid state. By using the preserved product the consumer wishes to be independent of the natural changeability of milk.

The consumer therefore expects condensed milk to be a product of uniformly creamy colour or delicate green translucence reflecting diffused light. (No crystal-refracted rays.) The smooth syrup should ooze from the tin in a heavy but mobile flow and should not exhibit any lumpiness or clotting, even though it spreads out to a tenuous, translucent sheet. On bringing a drop between thumb and first finger it should not be extensible to long threads—*i.e.*, it should not be highly tenacious. Placed upon the tongue, it should not give rise to any rancid, tallowy or similar taste, nor in particular to any sensation of a mealy or sandy character; rather should the taste be sugar-sweet, smoothly soft and mild, while both taste and odour should be reminiscent of fresh milk. In water or hot or cold beverages the viscous condensed milk should blend rapidly and completely merely by very gentle stirring. No flakes, skins or other undissolved solids should float on the surface, settle to the bottom or remain suspended in the liquid. Nor should any trace of solid residue be visible after pouring out the contents of the tin, be it in the form of minute, glistening crystals or of a mealy, powdery sediment. The syrup film remaining in contact with the inside of the tin should be completely removable by gentle rinsing with a little cold water.

Such in general are the qualities a consumer expects to find in condensed milk, and it need not be stressed that it must also satisfy the official hygienic and transport regulations. But while the latter requirements are easily satisfied, the manufacturer is faced with a much more difficult task in satisfying the consumer on all the details mentioned above and thereby imparting maximum suitability to his condensed milk for the consumer's special requirements.

If a given product is not as satisfactory as another in these respects, the middleman condemns it out of hand owing to its defective qualities, irrespective of whether its value *as a foodstuff* is greater or less than that of its rivals. The manufacturer of the more valuable product from the nutritional standpoint will not so readily find a market unless it satisfies the foregoing requirements, but even more difficult will it be to secure the higher price justified by its superior quality. Hence the first condition for fostering the condensed milk industry is: avoidance of all quality defects by eliminating their causes.

Defective Qualities: Their Causes and Avoidance

Many defects only come to light some time after manufacture. The irregularity with which such faults develop points to a special causative factor on the way to the consumer, and this apart from possible errors in actual production. In the modified forms into which individual components of the product are transformed by water-removal they are still capable of reacting upon each other chemically, physically and biologically. These reactions certainly proceed at a slower rate and with changed intensity and are invariably dependent in great measure upon the temperature.

1. **Darkening** of condensed milk is a consequence of sugar oxidation; particularly under tropical storage conditions (and even in sunlit windows) caramelisation occurs in a few weeks, sometimes even after a matter of days. The milk rapidly acquires an intense brown (chocolate) colour after exposure in the factory itself to high temperature, either on repeated occasions or for an excessively long single period—*e.g.*, during pre-heating or supplementary condensation of a too thin batch of concentrate. To avoid such changes resulting from carelessness, each processing stage should be controlled by automatic devices giving warning signals. If production errors are revealed in this manner which involve risk of later development of quality defects, it is better to market the batch without delay, at a lower price if necessary, rather than attempt to remedy the defect.

2. **Butter particles** separate not only from evaporated milk but also at times from sugared condensed milk when the cream has risen in the raw milk after long storage or when condensation is effected in vacuum pans so shaped

or so heated that a powerful wave-impulse is developed with consequent buttering of the milk, resulting in turn in agglomeration of fat particles to clots. Simultaneously, or in consequence, the viscosity of the condensed milk proves to be too low to restrain rising of the enlarged fat particles, the latter accordingly merging to a fat film after prolonged storage in the tin if not in the factory storage tanks. This type of defective batch can be generally put right by homogenising the entire batch as soon as microscopic examination has revealed the presence of enlarged fat particles or a cooled sample shows signs of rising.

3. **Metallic taste and odour** is so common a defect in condensed milk as to suggest that the cause does not reside, as hitherto unanimously believed, solely in occasional impurities in parts of the plant—*i.e.*, corrosion of the structural material by acid milk residues adhering to difficultly accessible points. A metal content of as little as a one-millionth part (equivalent to 1 grm. in 1,000 litres milk) has been proved to produce metallic taste. Storage or heating in dirty, spotted or corroded vessels thus leads very easily to an increase in the dissolved metal content of the milk to 5- or even 10-millionths. It has therefore been accepted in the past that flavour-deterioration will follow if the entire day's output flows during processing over one or more small areas where the minimum quantities of metal enter into lactic solution. But various scientific and practical studies of recent years—some, it is true, not quite complete—suggest with a high degree of probability that the chemical reactions on the inner metallic surfaces are by no means the sole factor in flavour modification of condensed milk. Far more probable is a metallic reaction upon the taste resulting from *mere contact* of liquid milk and *metal* (without any chemical change in the contacting materials) side by side with biological and physiological changes (clotting, digestibility, viscosity and so forth).

It remains an open question whether these so-called catalytic factors are brought into play or possibly intensified by certain electrical processes (as some investigators assume). It is certain, however, that such mysterious changes definitely occur in milk when kept and still more conspicuously when *warmed* in metal vessels, whereas no abnormal change in fresh milk is noted *when kept in porcelain, glass or earthenware containers.*

4. **Other flavour defects.** Scientific investigations have recently traced the origin of the metallic taste as well as of a series of other unpleasant flavour changes (oily, "gritty", "tallowy", blubbery, fishy, "old" or "storage" taste, etc.) in butter and other milk products (and more particularly in thickened and dried milk) to oxidation of the milk fats. This formation of fatty acids can be induced by ultra-violet rays and especially by the catalytic surface effect of certain heavy metals, this being inevitable in factories or dairies dealing with milk in metal containers and plant. High temperature intensifies the effect, as will be well recognised by every technical man, during heating or pasteurisation of milk.

The action of different metals upon milk has been widely investigated in respect of chemical corrosion phenomena. On the other hand, the consequences of catalysis and electrolysis have only been examined in a few isolated technical studies. Too big a digression would be involved in going into these studies in detail. Nor is it easy to draw a clear picture of the conclusions, because tests undertaken in different ways, with different materials, from different angles and with different objectives are not often amenable to comparison, and indeed may yield entirely divergent, if not contradictory, conclusions which are sometimes impossible to reconcile with the data acquired in actual practice.

The writer has accordingly made an attempt to give a schematic representation, based upon the data of science and practice, of the relative suitability of materials used in the construction of condensed milk plant and apparatus (Fig. 1). Its object is to show the degree in which the usual constructional materials (copper, iron, aluminium, stainless steel and glass-lined steel) are capable of influencing the quality of the final product under otherwise identical conditions. The *height* of the clotted lines indicates the position in the scale of improvement in both chemical and biological qualities attained when using each constructional material.

The *degree of blackness* of the dots signifies the increase in the commercial valuation of the improvements. It follows that good glass-lined steel will lead to the maximum improvement in quality over that obtained when using the customary copper or iron plant.

Although chemical decomposition and the catalytic action of metallic surfaces are referred to above as the most potent factors in the oxidation of fats, we should not omit to explain that bacterial and mould activity is the *primary cause* of flavour modification. These organisms not only form colonies at unclean areas of the plant but are originally present in the fresh milk just as are many "enzymatic" flavouring and odorous substances. Their most frequent appearance in spring and autumn and following grazing in certain districts in the milk of some cows and even of whole herds suggests the introduction of the flavouring agents from specific pasture plants.

Dr. Kertesz, of Budapest, who, like most other investigators, ascribes all flavour defects of milk, cream and butter, as well as of concentrated milk products, solely to fat oxidation and even believes certain heavy metals alone to be responsible for fat oxidation, asserts that the oxidising action can be *prevented* by increasing the proportion of certain protective agents present in each milk. He would con-

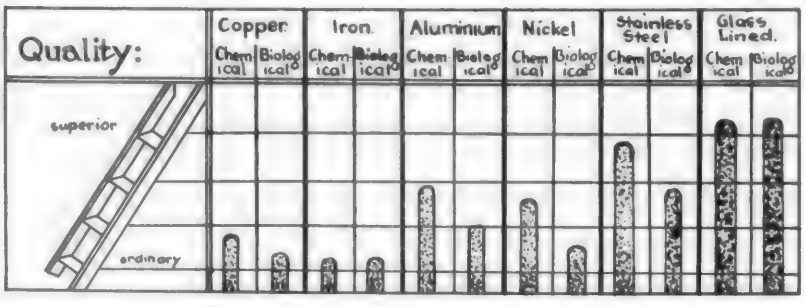


FIG. 1.—Influence of materials on quality.

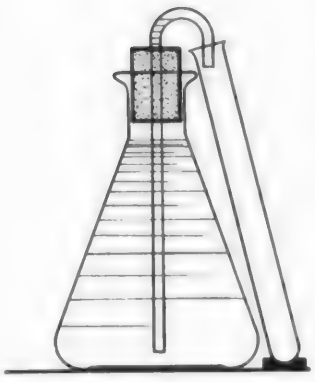


FIG. 2.—Simple apparatus for gas-producing bacteria test.

sequently attempt to eliminate flavour faults by inoculating fresh milk with a dry culture of the protective agents grown by Dr. S. Kende of Budapest. When condensing normal, healthy milk containing only the usual quantity of oxydative substances, such a protective inoculation would be superfluous as long as rapid multiplication of the harmful oxydative substances is not induced by processing the milk in metal apparatus.

All the foregoing practical considerations emphasise the urgent necessity, if flavour defects are to be avoided with certainty, of eliminating as far as possible all plant with unsuitable metallic surfaces.

5. **Bulged tops** is a defect notorious in the condensed milk industry and completely disastrous as far as saleableness is concerned. The avoidance of such completely spoilt batches is consequently one of the primary tasks of the works management. As a direct cause for tin bulging must be regarded the familiar fermentation process of the condensate, in consequence of which (usually with formation of clots and lumps in the original velvety smooth contents of the tin) gases of a partly evil-smelling and partly aromatic-smelling character are developed, the pressure from which forces the lids and bases outwards and even tears open the soldered seam of the body.

Less interesting than the type of ferments formed is the question as to how they enter the milk and react in the tin. In this connection it is a striking fact that the bulges occasionally develop in individual tins, in other cases in entire batches, and yet again in the output of entire days, but invariably not before several days or weeks after manufacture. From the extent of the evil can be inferred whether the original germs of fermenting organisms were present in individual tins before filling, whether colonies had been established in the plant and vessels through which the milk passed, or whether they were present originally in the raw milk or in the sugar solution. Lack of cleanliness in collection of the raw milk, or impure sugar owing to lack of dry storage, are frequently the fundamental causes for the development of bulged heads.

Since it has been scientifically established that to some extent certain bacteria, generally yeast cells, cause gaseous fermentation in the tins following decomposition of protein or sugar, the technical man can gain but little by searching for sources of gas formation. It is not always possible to call in a bacteriologist to trace the causes; on the other hand, there is the danger of producing an infected product for days and weeks at a stretch, which can only be recognised as spoilt after long storage and the return of distorted tins by the customers.

At any rate, absolute cleanliness of the entire plant is the best precaution against infection; and this is most easily achieved in those plants designed to prevent retention of traces of milk—*i.e.*, containing a minimum number of angles and corners, bolts or screws and the like, or which are free from corroded surfaces or the possibility of corrosion. But even the greatest possibility of thorough cleaning offers no guarantee that this is actually carried out. It is impossible to exclude, but only to limit, the colonisation of dangerous micro-organisms by using suitably designed plant. Control of production by self-registering instruments on individual parts of the plant is well known.

Many factories are accustomed to warm-store the filled tins for days and even weeks before labelling, when any bulging at the top or bottom is detected by sensitive contact instruments, thus avoiding despatch of those doubtful tins. Less familiar, but at least as satisfactory, is the following method, which permits detection of gas-forming organisms during the actual process of manufacture of the condensate. Fig. 2 shows a small device that can be easily and rapidly assembled in the simplest laboratory. A small Erlenmeyer flask is fitted with a rubber stopper drilled to take a **U**-tube with limbs of different lengths; the long limb reaches almost to the bottom of the flask and a test tube is placed below the end of the short limb. The flask is then filled almost to the stopper with the milk sample warmed to the incubating temperature, the stopper with the glass tube pushed into the neck of the flask so as to cause the milk to rise to the bend of the glass tube. The flask is then placed in the incubator, the test tube placed in position, and micro-organisms stimulated to vigorous gas evolution in a few hours by suitable temperature adjustment. The resulting gas pressure above the level of the milk eventually forces a small quantity of milk into the glass tube which flows through the bend into the test tube. If this control method is applied during the manufacturing process with milks from various stages—*e.g.*, from the receiving tank, after pre-heating, after cleaning, after mixing with the sugar solution, after condensation and after cooling—it is possible to conclude with a fair degree of certainty whether and where a source of infection inside the factory requires to be tracked down.

6. **Thickening** of condensed milk during storage is a common phenomenon and one which diminishes the value of the product and even renders it entirely unsaleable. As soon as the condensed milk, the viscosity of which in the fresh state resembles that of thick cream, does not flow smoothly from the tin, or resembles soft cheese in consistency, it is no longer saleable. The same factors are responsible for this change as are ultimately responsible for bulged heads. If, in addition, the sugar content is too low—*i.e.*, forms less than 46 per cent. of the concentrated solution—the latter is incapable of suppressing the activity of any micro-organisms that may be present to a substantial extent. A high content of non-fatty solids in the raw milk increases the thickening tendency. The trade has recognised a maximum limit of 26 per cent. in the condensate, any larger proportion inevitably causing after-thickening. This limit will naturally be easily reached or exceeded in early summer owing to the supply of colostrum milk.

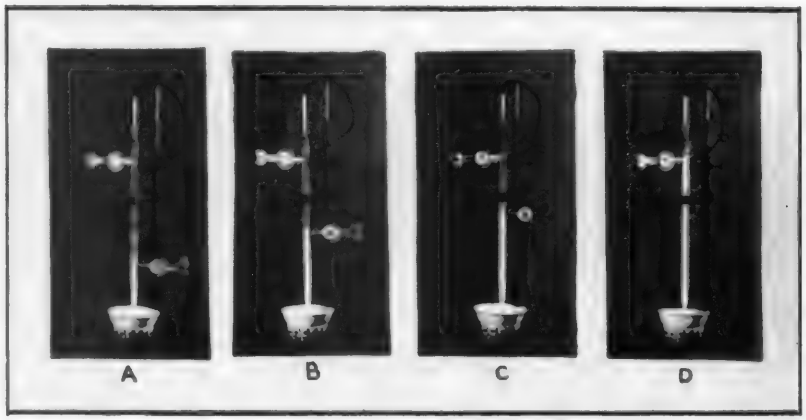


FIG. 3.—Viscosity test by discharged milk.

Less clear, on the other hand, is the influence upon the thickening tendency of the degree of heat applied in the various stages of manufacture. Thus the tendency is reduced:

(*a*) If the pre-heating temperature of the milk is not allowed to rise above 64° C. or, in the case of momentary high-temperature heating, it is brought to at least 110° C.;

(*b*) If during condensation the boiling temperature is gradually reduced below 55° C. towards the end of the operation by increasing the vacuum, and immediately afterwards is cooled down as rapidly as possible;

(*c*) If the storage temperature of the filled tins is not allowed to rise above 7° to 10° C., at which temperature thickening is completely suppressed.

In view of the last observation, the prolonged storage in the factory at incubating temperature prior to despatch must be regarded as a two-edged sword, the application of which is nevertheless justified by the circumstance that it will certainly only be possible in rare cases to control the storage temperature after leaving the factory. It would be particularly difficult to maintain a sufficiently low temperature to suppress the after-thickening tendency. Hence it will be more advisable in many cases to market only those tins in which no tendency towards after-thickening or fermentation has been observed, rather than those in which the possibility of this tendency still exists.

The influence of the pre-heating temperature upon subsequent increase in viscosity (after-thickening) is vividly demonstrated by the following simple test: Four different milk samples were pre-heated at different temperatures but subsequently normally thickened in the same manner. After cooling to 15° C., exactly 25 c.c. of each sample flowed through the same 25 c.c. pipette in a period of 3 minutes. After storage for 3 weeks in a closed tin marked viscosity changes had occurred, as indicated by the quantity of milk sample warmed to 15° C. flowing out within 3 minutes:

Pre-heating Temperature.		*Outflow.*	*Figure.*
° C.	*° F.*	*C.c.*	
120	248	19	3*a*
105	221	13	3*b*
95	205	10	3*c*
63	145	25	3*d*

As will be noted, there was no thickening after pre-heating up to 63° C., whereas greatest after-thickening (viscosity) followed pre-heating to 95° C. And now for practical exploitation of these facts: Determine the viscosity of each batch with any instrument (even the elementary type of Fig. 3) and compare it with the final product at the same temperature before leaving the works. Differences point to the inadvisability of any further prolonged storage.

7. **Milk sugar crystals** present in the condensed milk are unavoidable, since it contains more milk sugar than its water content at normal temperature is capable of dissolving. Sugared condensed milk contains about 13 per cent. of milk sugar and about 25 per cent. water. Now, since about 2½ parts cold water are required to dissolve 1 part milk sugar, the excess held in solution in the warm condensed milk is bound to separate in crystals on cooling. Whether this crystal separation is a hindrance to sales and renders the product inferior depends upon the size of the separated crystals. A milk can only be regarded as a first quality article if it dissolves smoothly on the tongue like syrup and does not leave any sensation of a granular or even powdery deposit. On pressing a drop between two glass plates (Fig. 4A) it takes the appearance in transmitted light of a somewhat cloudy layer containing no granular irregularities. And even after keeping for a considerable time the milk should not leave any granular, powdery or crystalline sediment in the tin. The tiny crystals invisible to the naked eye invariably remain *suspended* in the thick syrup under all conditions. Under the microscope they are found to be less than 10μ in size (Fig. 5*a*). But if the crystals have grown to any considerable length, they leave on the tongue a sensation of powderiness and a drop expressed between glass sheets is seen (Fig. 4B) to contain extremely fine lustrous or dark specks. The cross-wire in the microscope permits detection of such crystals to a length of 15μ (Fig. 5*b*), and the milk is then judged by the trade to be mealy and useless for many purposes. If the crystals grow to a size of 30μ (Fig. 5*c*) the milk is "sandy", and if still larger the milk is "gritty" (Fig. 5*d*). In both cases the crystals settle to a compact mass on the base and sides of the tin and cannot again be distributed in the condensate by vigorous stirring as is the case with the mealy deposit. Such a product is entirely unsaleable.

The outstanding task of the condensed milk plant manager is therefore to direct crystallisation of the excess milk sugar during cooling of the condensate so as

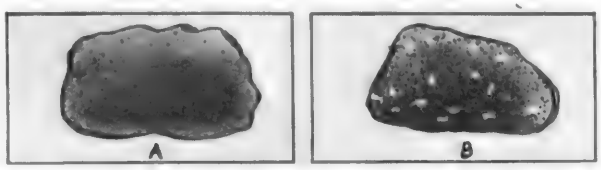


FIG. 4.—Condensed milk between glass plates—A, Smooth; B, Sandy.

to produce an infinite number of infinitesimal particles. To reach this objective a number of fundamental rules have been developed for operation of the cooling process, application of which has been facilitated by specially designed cooling plants.

In all these methods "inoculation" with infinitesimal particles of sugar is an essential step in controlling crystallisation of the milk sugar excess separating as a result of fall of temperature. In this operation the vaster the number of crystals formed the smaller their size, and if their size is so small that they remain permanently suspended in the condensate an effort should be made to avoid an individual crystal length of more than 10μ.

The carrying-out of this requirement in the course of the crystallisation process during the cooling of milk is regulated by the type of the apparatus, but also calls for the most careful supervision and a knowledge of the nature of the condensate in respect of temperature, viscosity and content of acid, milk sugar and bacteria.

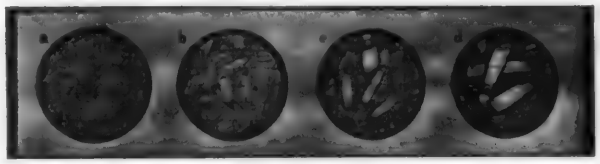


FIG. 5.—Crystals in sweetened condensed milk—a, 10 microns, smooth; b, 10-15 microns, mealy; c, 20-30 microns, sandy; d, 30-50 microns, gritty.

A GERMAN MILK PASTEURISING PLANT

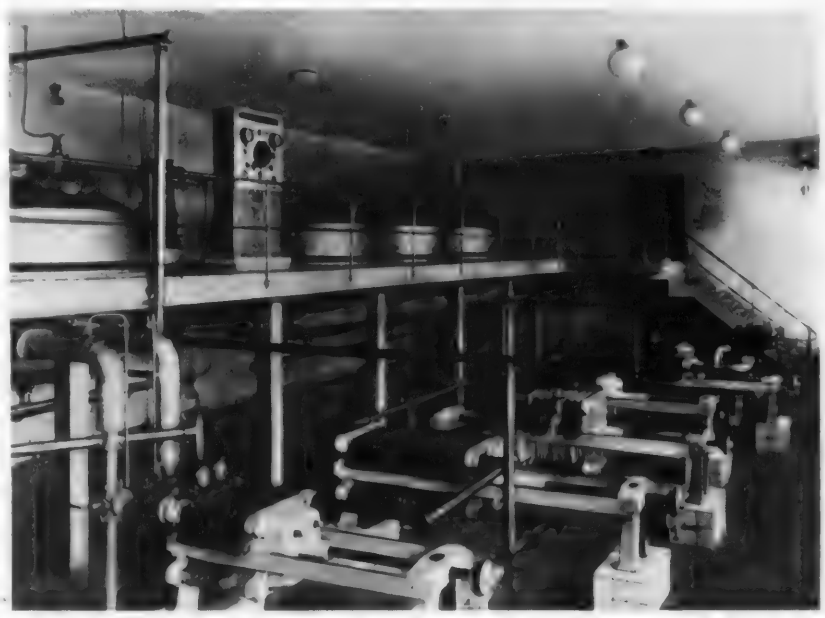
ONE of the more interesting pasteurising installations on the Continent, in which every precaution is taken to obtain a maximum efficiency in the various parts, is that of the Würtemberg dairy at Stuttgart. This plant has a capacity of about 5,280 gallons per hour and is arranged in a slightly different manner from most installations of this type.

The raw milk on reception is pumped immediately into a first plate type temperature exchanger by means of a centrifugal pump. In this the milk is raised to a temperature of about 85° to 95° F. by the action of hot milk passing on the other side of the plates. At this temperature the milk passes through a filter in which the milk passes from either side into a central compartment, connected with the next heater.

After filtration the milk passes into a second temperature exchanger in which its temperature is raised, still by the action of hot milk, to about 122° F. After this treatment it passes through a third heater, which constitutes the pasteuriser proper, and in which the heating is by hot water which raises its temperature to about 149° F. At this temperature the milk goes into a compensator tank, from which it is drawn by suction into storage tanks in aluminium with cork insulation, in which a vacuum pump is cut out, and air admitted to the tank so that the milk remains at normal air pressure and at a temperature of 145° to 149° for 30 minutes. During this time it is left without agitating.

At the end of this time the milk is run out through the second, then through the first temperature exchanger, in which it gives up most of its heat to the incoming cold milk. When it has been cooled as much as possible in this way it is passed through a third plate apparatus, in which it is cooled by the action of cold water, and finally through a fourth, in which brine brings it down to a temperature of about 40° F., at which temperature it goes to the storage tanks connecting to the filling machines.

The use of this series of plate apparatus, in each of which the change in temperature is relatively small, permits a considerable economy, as the only apparatus which actually require any outside source of energy are the terminal ones of each series—that is, the pasteuriser, which requires heat, and the brine cooler, the others making use entirely of the heat or cold contained in the milk or in water taken from the tap.



The Pasteurising installation of the Würtemburg Dairy at Stuttgart. The picture shows a 5,300 gallon per hour A.P.V. Vacuum-Pressure Pasteurising Plant with A.P.V. Plate Pasteurisers in the foreground, manufactured in Germany under licence from the Aluminium Plant and Vessel Co., Ltd., of Wandsworth.

Analytical Methods applied to CEREAL PRODUCTS

By T. H. Fairbrother, M.Sc., F.I.C.

In the second part of this article, which was commenced last month, the author deals with Ash, Fibre, Cellulose and Pigments, and tests occasioned by Bleaching. The third and concluding part will be given next month.

ASH

THE ASH test is of importance as it is a fairly reliable index of flour grade.

The official method in America is to weigh 3 to 5 grm. of the well-mixed sample into a shallow, relatively broad ashing dish which has been ignited, cooled in a desiccator and weighed. The flour is incinerated in a furnace at 550° C. until no further loss occurs. Micka (*Cereal Chemistry*, vol. 4, p. 467) states that the best method for ashing flour is the direct burning at high temperature in platinum with no addition of other substances. The writer, however, much prefers the method suggested by Hertwig, Raymond and Bailey (*Cereal Chemistry*, vol. 1, p. 82) with a slight modification. 3 grm. of flour are weighed accurately into a platinum dish and 10 c.c. of a mixture of pure glycerine and alcohol are added. The dish is gently rotated to mix the flour and liquid and then placed on the tip of the muffle, when the alcohol ignites quietly and the flour remains as a spongy black mass. The dish is then placed inside the muffle and heated at 550° C. for 1½ hours. It is cooled in a desiccator over calcium carbide.

Brendle (*Cereal Chemistry*, vol. 3, p. 225) burns the flour to a cinder, then adds 2 c.c. calcium acetate solution and completes the incineration in presence of oxygen at 1,500° F. Magnesium acetate has also been used. According to Otterström (*Brit. Chem. Abs. B.*, 1934, 904), differences in the temperature of ignition (650° to 800° C.) and in the size of sample used do not affect the satisfactory character of the magnesium acetate method. The same worker (*Mühlen lab.*, 1935, vol. 5, p. 45) has made some refinements which shorten the time to 1 hour. The writer has had very consistent results with the alcohol glycerine method, which, on the whole, appears to be the most satisfactory.

FIBRE OR CELLULOSE

This is one of the few cases in cereal chemistry where there is an official test laid down in this country. The method for the determination of crude fibre is laid down in the Fertilisers and Feeding Stuffs Act, 1926. About 2·5 grm. of accurately weighed sample are introduced into a Soxhlet thimble and extracted with petroleum ether for 1 hour. (The writer finds the Bolton and Revis Soxhlet the most suitable.) After the fat extraction the sample is dried and transferred to a 1,000 c.c. conical pyrex flask, 200 c.c. of boiling sulphuric acid (1·25 per cent.) are added, the flask is attached to a reflux condenser and boiled gently for exactly 30 minutes. The liquor is then filtered through a disc of fine linen (the official method stipulates paper, but the writer has carried out extensive tests and finds no difference in recorded fibre whether linen or paper is used, and linen is undoubtedly quicker). The residue is washed with boiling water and transferred

An experimental mill, where small samples of wheat are milled for laboratory examination.

back to the flask by means of 200 c.c. boiling caustic soda (1·25 per cent.) contained in a wash bottle. This is kept at the boil for exactly 30 minutes, then filtered through a tared paper washed with boiling water, 1 per cent. HCl, water, alcohol and ether and dried and weighed. The paper and fibre are ashed and the ash deducted from gross fibre to give crude fibre. The Act allows for a margin of 12½ per cent. as experimental error, and this is ample. As the quantities, strengths and times are laid down in the Act very little variation is possible. Some workers boil in open flasks and make up the volume from time to time. The writer prefers to use a reflux condenser at an angle of 30° from the horizontal; this gives a good surface in the flask. Argand burners are excellent for maintaining a steady boil. There is always some objectionable frothing, which may cause portions of the fibre to adhere to the side of the flask. This can be obviated by passing thin glass tubes, about ⅛-inch diameter, down the inner tube of the condenser and passing a gentle current of air over the surface. As the law stands at present, crude fibre must be determined as stated, but the method is rather unsatisfactory, and actually it is not a determination of cellulose, it is an estimation of what is left after digestion for two periods of ½ hour with 1·25 per cent. sulphuric acid and caustic soda respectively. Williams and Olmstead (*J. Biol. Chem.*, 1935, vol. 108, p. 653) state that the indigestible residue consists of lignin, cellulose and hemicelluloses, and suggest the separate determination of these three fractions. Norman (*J. Agric. Sci.*, 1935, vol. 25, p. 529) has discussed the differences and errors in the crude fibre determination.

Cellulose, furfuraldehyde, lignin and protein determinations were carried out on various materials including bran. The cellulose was partially attacked and lignin extensively removed. The lignin content of crude fibre fractions varies considerably, highly lignified materials do not necessarily yield a crude fibre high in lignin. Norman argues that since the presence of lignin exercises a direct effect on the digestibility of the material, any empirical method should include all the lignin, and alkaline treatment must be avoided. Acid hydrolysis might be used, if a correction for protein is made in the case of materials of high nitrogen content, and a lignin determination effected. The whole problem is by no means settled yet. The only virtue about the official method is that it is the same in all laboratories, and hence comparable results are obtainable among different workers. This, of course, has a commercial value.

PIGMENTS AND TESTS OCCASIONED BY BLEACHING

As there is a great demand for white flour the examination of flour from a colour point of view is important.

The Pekar Test

This is a test which has long been practised in every flour mill, and undoubtedly it is very useful for examining the colour of dry and wet flour. Flour samples are placed on a slab of glass and pressed down into a neat compact layer with straight lines of demarcation between the different samples. The colour is examined in the dry and the slab is then carefully immersed in still, clean water, taking care to avoid bubbles or waves on the surface. The slab is withdrawn and the colour in the wet noted. In America the slabs are dried at gentle heat. This test gives a very good idea of grade, granulation and whether the sample has been bleached or not. Obviously the samples should always be examined in a dark room with a daylight lamp so that the intensity of light is always constant. Baker, Parker and Freese (*Cereal Chemistry*, vol. 10, p. 437) have applied the use of Maxwell discs to this test. The sample is prepared on the sample wheel of a colorimeter designed for the purpose, and this permits of some sort of numerical expression.

Numerical Expression of Colour

The limitations of the Pekar test in this direction have led to many investigations in order to express colour in numerical units. This has involved really a determination of the component parts of flour that give rise to colour—viz., carotin and xanthophyll. Of the various methods suggested, probably that of Kent-Jones and Herd (*Cereal Chemistry*, vol. 6, p. 60) is the most useful. The substances soluble in petrol and in alkaline methyl alcohol are extracted separately and compared with standards.

(1) 20 grm. of flour are introduced into an 8-oz. bottle and 100 c.c. of standard grade petrol added. The bottle is well stoppered and shaken periodically for about 15 minutes and allowed to stand for 16 hours and then re-shaken. The flour is allowed to settle and the petrol extract is filtered into a dry conical flask. 50 c.c. filtrate are placed in a Nessler for comparison with a standard. The standard contains 10 c.c. 0·5 per cent. potassium chromate and 1·5 c.c. 10 per cent. cobalt nitrate solution made up to 100 c.c. with distilled water.

(2) 20 grm. flour are placed in a wide-necked 8-oz. glass-stoppered bottle and 50 c.c. distilled water added and well shaken. 5 c.c. N.NaOH are then added and the bottle is shaken intermittently for 1 hour. After this time 100 c.c. methyl alcohol are added and the whole shaken for 16 hours. The supernatant liquid is decanted into a beaker and glutenin is precipitated by N/5 HCl. The liquid is allowed to stand for 1 hour and then centrifuged. The supernatant liquid is filtered through a No. 5 Whatman paper into a clean dry beaker. 50 c.c. of this filtrate are taken and 1 c.c. NaOH solution added to bring back the colour of the pigment. The liquid is placed in a Nessler for comparison with a standard in a specially designed colorimeter. The standard is 5 c.c. of 0·5 per cent. potassium chromate and 2 c.c. 10 per cent. cobalt nitrate made up to 100 c.c. with water.

As pointed out above, this is probably the most satisfactory method available, but there are difficulties, and it has been severely criticised by Vissert Hooft and Leeuw (*Cereal Chemistry*, vol. 5, p. 35). While Kent Jones and Herd (*Cereal Chemistry*, vol. 6, p. 33) made an adequate reply, this criticism does indicate the difficulties that may be experienced. Many factors arise which present difficulties in the comparison of results obtained in different laboratories. The colour of the reference sample is not identical. Jorgensen (*Biochem. Zeit.*, vol. 186, p. 485)

found that by varying the buffer mixture in which the chromate is dissolved it is possible to prepare solutions possessing many different defined red and yellow colour tones. He recommended a standard made up from 1 c.c. of 0·05 per cent. potassium chromate and 0·5 c.c. M/15 disodium hydrogen phosphate and 9·5 c.c. M/15 potassium dihydrogen phosphate. Schertz (*J. Agric. Research*, vol. 26, p. 383) reported a variation of 33⅓ per cent. in comparing the same concentration of carotin solution on both sides of a Duboscq colorimeter. To eliminate some of these difficulties Ferrari and Bailey (*Cereal Chemistry*, vol. 6, pp. 218 and 347) have developed a spectrophotometric method. They claim that pure carotin concentration can be measured by determining the transmittancy at wave-length 435·8 mμ of its petroleum ether solution. As this method measures the spectral distribution of the radiant energy which evokes the colour it is independent of standards and personal error, which are the main difficulties in colorimetric determinations.

Simpson (*Cereal Chemistry*, 1935, p. 569) has described a simple method for determining the yellowness and grade of wheat flour. The yellowness or degree of bleaching is determined by finding the amount of carotin present and the grade or degree of offal contamination by determination of the amount of flavones. No more elaborate apparatus than a standard type of colorimeter is necessary. It depends on the extraction of flour with pure acetone, from which the yellow colour due to carotins can be determined, and again with 80 per cent. acetone, which after making alkaline, measurement of the flavone yellow colour gives a measure of the grade of the flour.

Tests Caused by Bleaching

One of the most popular bleaching agents in this country is chlorine, and it is frequently necessary to estimate the residual chlorine.

The method usually employed in the writer's laboratory is that described in Methods of Analysis of the Association of Official Agricultural Chemists. The oil obtained from 100 grm. of flour is carefully ashed and the chlorine determined by silver nitrate titration using potassium chromate as indicator. Seidenberg (*J. Assoc. Off. Agric. Chem.*, 1925, p. 676) states that the fat is incompletely extracted, and recommends hydrolysis with 70 per cent. alcohol followed by an ether and light petroleum extraction. In 1928 the same author claimed that his method showed a sharper difference between treated and untreated flour. Kent Jones and Herd (*J. Soc. Chem. Ind.*, 1930, p. 223 T) have described a more refined method which has been evolved on the lines of Bailey's procedure. The method is somewhat laborious and complicated, and the reader is referred to the original paper for full and minute details. This method is eminently suitable for the determination of minute traces in flour left after nitrogen trichloride treatment.

Residual Nitrites

Another popular bleaching agent is nitrogen peroxide. Residual nitrites are determined as follows: 10 grm. flour are shaken with 100 c.c. distilled water for 1 hour in a mechanical shaker. The bottles are then centrifuged and the supernatant liquid decanted through a filter. A similar extract is made from flour which is known to be free from nitrites for making up standards. A standard nitrite solution is made from pure potassium nitrite. A fairly strong solution is made up for stock, and this is replaced once a month. For each determination this is diluted so that each cubic centimetre is approximately equivalent to 1 part per million. 10 c.c. of the nitrite free-flour extract are pipetted into 50 c.c. Nessler's and 1, 2, 3, 4 and 5 c.c. of the standard nitrite solution are added. 10 c.c. of the extracts of the flour to be tested are added to other 50 c.c. Nessler's. 2 c.c. of a reagent are added to each Nessler, and all are made up to the mark. The contents of each are transferred to small flasks and heated at 80° C. for 5 minutes and then replaced in the Nessler's and compared with the standards. The reagent is made by mixing equal portions of sulphanilic acid and alphanaphthylamine solutions in acetic acid (2·5 grm. sulphanilic in 750 c.c. 20 per cent. acetic acid and 1 grm. alphanaphthylamine in 750 c.c. 20 per cent. acetic acid). These must be kept separately in the dark and only mixed just prior to use.

Benzoyl Peroxide

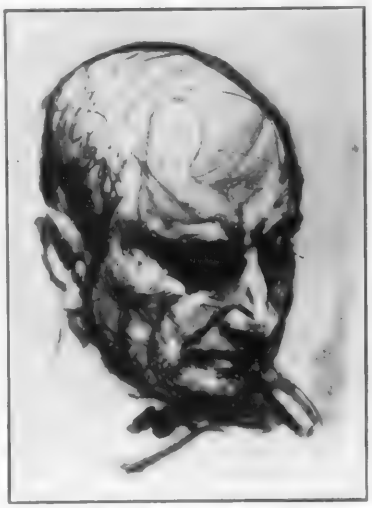
Benzoyl peroxide is sometimes used for bleaching flour, and the usual method for its detection depends on the oxidising action of any unchanged peroxide. In effecting its bleaching action the peroxide becomes reduced to benzoic acid, and, obviously, if all the added peroxide has been so changed there will not remain any to indicate that the flour has been treated. To overcome this Nichols (*Analyst*, 1933, p. 4) has devised a method to determine residual benzoic acid. About 40 grm. of calcium chloride and 100 c.c. water are placed in a litre flask, 50 grm. of the flour to be tested and 10 c.c. conc. HCl are added and the flask connected with a steam distillation apparatus. Steam is passed very cautiously at first, until the mass ceases to froth, then rapidly. About 300 c.c. distillate are collected, saturated with common salt and extracted twice with 50 c.c. ether. The ether is evaporated at a temperature of about 30° C., a rapid current of air being drawn over the surface. When the residue is practically dry 5 c.c. of acetone are used to wash down the sides of the vessel and to dissolve the residue. 5 c.c. 2N.NaOH are added. The mixture is diluted with an equal volume of water and the acetone is boiled off. The liquid is cooled to 50-60° C. and treated with permanganate solution until an excess is evident by the colour and 10 c.c. of $2N.H_2SO_4$ are added, and the solution is just decolorised by the addition of oxalic acid. Any insoluble fatty acids are filtered off and the solution is extracted twice with about 20 c.c. of a mixture of equal parts of ether and petroleum spirit. The extracts are evaporated to dryness in a boiling tube at 30° C., a current of air being drawn over the surface. When the last trace of solvent has disappeared the benzoic acid will be visible as a crystalline deposit. The residue is dissolved in 15 c.c. warm water, cooled, and 1 c.c. iron solution (2·7 grm.

(*Continued on page* 359.)

STILL FRESH after FIVE MONTHS

The Hofius process for keeping milk fresh for long periods is described by Dr. A. van RAALTE of the Amsterdam Municipal Laboratories, who has carried out tests yielding results of considerable scientific and economic importance.

THE INVENTION of Mr. Hofius, chemist of Duisburg, Germany, which makes it possible to keep milk and cream for several weeks and to preserve their original taste, sounds so fantastic at first that it is impossible not to feel rather sceptical. Essentially the method consists in keeping the milk or cream in a container in contact with oxygen under a pressure of 10 atmospheres and at a temperature of 4° to 8° C.



Dr. A. van Raalte.

It was of course known that milk kept at a low temperature stays fresh much longer than when kept at a higher temperature. But it was also known that fat turns rancid in the presence of oxygen. There was, therefore, some reason for doubt: the presence of oxygen might affect the growth of bacteria sufficiently to keep the milk fresh, but would not milk so preserved have a rancid taste?

Dairymen in Holland produced a number of very interesting reports from the German investigators, and when we were asked to carry out a series of tests in the pre-cooling rooms of an Amsterdam dairy the opportunity was gladly accepted. From July 4 to August 20, 1935, raw milk preserved as described remained remarkably fresh and of good taste, the acidity only increasing from 7 to 9. The number of bacteria, however, increased from 70,000 to 2,500,000. Milk kept in the same storage room in an ordinary vessel had, however, become sour by July 16. From this test it appears that milk kept in an ordinary open vessel at the same temperature of 4° to 8° C. had changed within 12 days (it was not possible to ascertain after how many days this milk was still fresh; on the fifth day it was, however, absolutely fresh); but the milk stored in a Hofius tank still had a normal acidity after 47 days. From the data obtained it appears also that oxygen under pressure does reduce the growth of bacteria to an enormous extent. As a result of this test it had to be admitted that the Hofius tank made it possible to keep milk in good condition for about 7 weeks at least.

On January 17, 1936, a series of tests was commenced with raw milk, pasteurised milk and pasteurised cream. These were kept in Hofius tanks in an automatic refrigerator in which the temperature remained constantly at 4° to 5° C. The results of these tests were very interesting indeed. Raw milk and pasteurised cream were still fresh after 5 months. The pasteurised milk, however, only remained fresh for just under 3 months. The pasteurised milk used for this test had been pasteurised in a dairy where milk is always heated to a high temperature. A further test was accordingly undertaken with milk from a dairy where it is pasteurised in a Stassano apparatus at 73° C. This pasteurised milk had an acidity of 6·8 on April 29, the day the test was started, and of 7·2 on July 22 (after 84 days). The bacterial count at the commencement of the test was 10,000, and, after oxygenising, 2,000. On June 3 (after 35 days) the count was 64,000, and this number had decreased to 3,000 on July 22.

The discovery of Hofius thus makes it possible to keep milk and cream for several weeks and to transport them over considerable distances in suitably constructed containers. It has not yet been ascertained exactly what takes place under the conditions obtaining, but it is certain that the action of the acid-forming bacteria is arrested and that the coli bacteria are fairly quickly destroyed. The process is undoubtedly of great scientific interest and it may easily prove of considerable economic importance.

ANALYTICAL METHODS APPLIED TO CEREAL PRODUCTS

(Continued from page 358.)

$FeCl_3$ + 13 c.c. N.H_2SO_4 to 100 c.c.) and 1 c.c. 0·1 per cent. H_2O_2 solution (1 c.c. 20 vol. H_2O_2 diluted to 60 c.c. = 0·1 per cent.) are added and the mixture heated just to boiling point. After the addition of 0·5 c.c. of N.NaOH solution the mixture is filtered while hot and the precipitate is washed with hot water until the filtrate measures 50 c.c. To the cold filtrate one drop of iron solution is added, and the colour produced is matched by adding 0·01 per cent. salicylic acid solution to a solution obtained by adding the reagent to 15 c.c. water. The salicylic acid solution is standardised against the colour produced when the test is carried out on a known quantity of benzoic acid.

(To be continued.)

MALTED MILK

By H. Silman, B.Sc., A.I.C.

The author traces the steps in the manufacture of malted milk, which is to-day becoming one of the important products contributing to the increase in the consumption of milk.

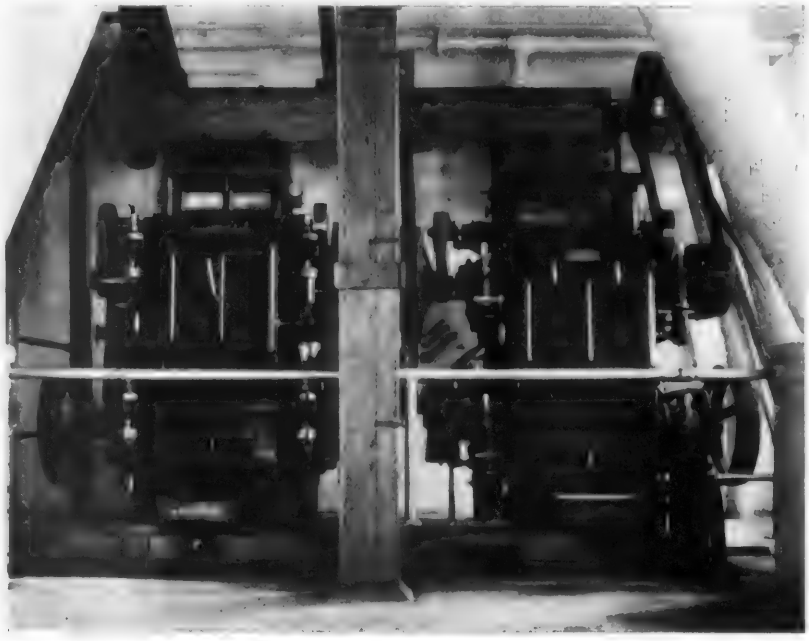
THE INCREASING realisation both by medical men and by the public in general of the value of milk as an important dietetic factor is likely to increase the consumption of this commodity in all its forms in this country in the near future. "Milk Bars" have already been established in many parts of the country. From the point of view of palatability, high concentration of proteins and vitamins, and well-balanced constitution generally, malted milk occupies an important position in the realm of milk foods. It is, moreover, a form of milk which is readily available and transportable without the danger of germ contamination to which all liquid milk is more or less subject.

The manufacture of malted milk embodies a technique halfway between that of the brewer and the dried milk manufacturer, inasmuch as it consists of combining whole milk with the liquid separated from a mash of barley malt and wheat meal or flour. This method of production must be adopted, since it is not possible to produce a satisfactory malted milk by simple mixture of dried malt extract and milk powder for reasons which will become apparent in the course of this article.

The Malt

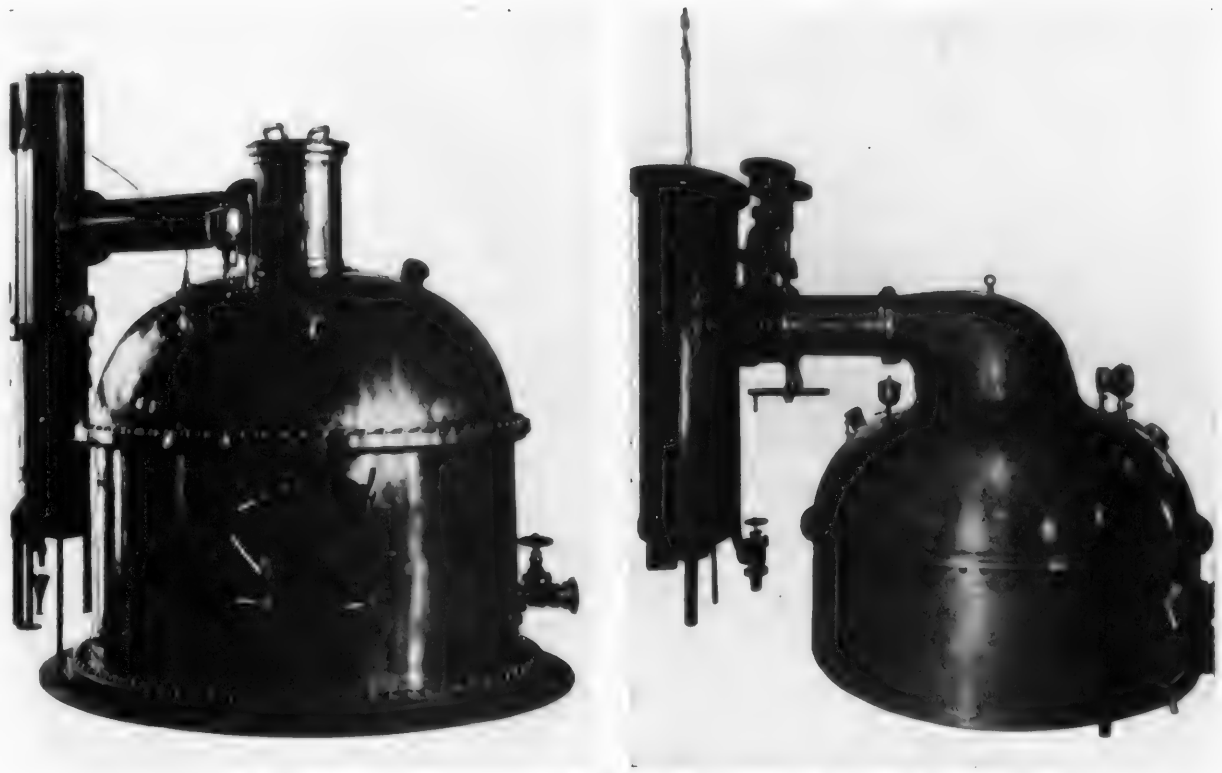
The malt is invariably prepared from barley because of the round, pleasant flavour of malt derived from this source. Only the best quality grain with uniform, hard, white kernels is suitable. Lower grade material will not germinate properly, with the result that a sufficiency of enzymes will not be produced. The barley is first screened and cleaned to remove any impurities; it is important to remove the dust adhering to the grain, as it always contains large numbers of mould spores and bacteria which might adversely affect the flavour of the malt if allowed to develop unchecked.

The next process is the steeping of the grain in water, during which it swells and absorbs a considerable proportion of moisture which may vary from 25 to 35 per cent. The steeping is carried out in large tanks, the layer of barley being submerged below a foot or two of water for a period of from one to three days, depending on the nature of the water and on the type of grain. Soft waters are more readily absorbed by the grain than those containing a high proportion of salts. The water is maintained at a temperature of about 68° F., and is changed frequently to prevent it becoming stale and to provide the barley with a sufficiency of oxygen. It is then ready for the germinating stage.



Grist mills with elevator and conveyor in a malted milk plant.

In the case of home-grown barleys which have been harvested at a time when they are liable to have a high moisture content it is advisable to submit the grain to a preliminary kilning or "sweating" process prior to steeping by heating for a varying period at a temperature of from 100° to 120° F. to ensure that the grains ultimately contain a more or less uniform proportion of water, as otherwise the germinating process will tend to be irregular. Where the grain has been harvested dry or has been stacked the preliminary "sweating" may generally be dispensed with.



Two types of vacuum evaporators used in the manufacture of malted milk.

Germination of the Barley

Germination of the soaked barley is conducted under suitable conditions of temperature and humidity, usually by spreading the material on to open floors to a depth of 8 to 10 inches where conditions may be controlled by varying the depth of the barley, raking the mass to promote aeration and occasionally sprinkling with water. Malting was, and still is to a considerable extent in this country, a seasonal occupation lasting from October till about April, but the introduction of machinery and scientific control now renders it possible to carry on the process at all times of the year.

The pneumatic drum system makes use of a slowly rotating, horizontal drum in which the grain is agitated gently, whilst suitably conditioned moist air is fed into the drum and carried away by air ducts. Other forms of apparatus make use of large tanks with perforated floors upon which the grain is spread to a depth of some 2 feet. Through these floors the moist air is drawn by a system of fans, whilst the material itself is stirred mechanically and sprinkled with water whenever necessary. No water should be added during the early part of the process until the grain has attained the temperature at which germination commences. Adequate ventilation is important, as heat is developed during germination which will cause the process to take place too rapidly unless it is carefully watched; too rapid germination is to be deprecated, as it tends to promote excessive starch destruction in the kernel and unnecessary root development. Home-grown barleys are best germinated at about 65° F., a process which takes about 10 or 11 days working on the floor system. In the case of foreign barleys or the coarser home products a somewhat higher temperature of 70° or 75° F. is employed, and by the use of the drum or trough system germination can be completed in 6 or 7 days. A temperature difference of 10 degrees needs generally to be maintained between the air and the barley in order to ensure that the temperature of the latter does not rise too high.

The object of the malting process, as far as the production of malted milk is concerned, is to promote the development of the sprout within the grain to such a stage that the optimum percentage of diastases will be produced for the rapid conversion of the total starch into dextrins and maltose, as will be described later. A high maltose content is desirable, the dextrins being kept as low as possible. Proteolytic enzymes are also produced at the same time which break down the protein material of the grain into soluble and readily assimilable peptones and related products; cystase is developed and serves to dissolve the cellulose tissue surrounding the starch cells of the endosperm, thus releasing their contents in such a form that they are readily acted upon by the diastase.

To achieve these objects the germination process is carried on until the sprout has developed to about three-quarters of the length of the grain and the endosperm shows a clear white cross-section. Further development is then arrested by transferring the grain to a kiln for drying.

The Drying Process

When the "green" malt is judged to have reached the right stage of development it is transferred to a kiln

where its moisture content is reduced from about 50 per cent. down to under 3 per cent. This is accomplished by spreading the grain on a series of perforated floors, hot air being drawn from below by means of fans placed at the top. The fans facilitate the withdrawal of moisture, but they are not absolutely essential.

The drying of the malt for the purpose of making malted milk should be conducted at as low a temperature as is practicable, since the higher the drying temperature the darker the colour of the malt becomes. This is to be avoided, as a dark colour in the finished product is unattractive. A drying temperature of under 120° F. is to be aimed at, although higher temperatures are generally employed to complete the process; for the first day or two it is best to dry at about 80° or 90° F. in order to avoid damaging the enzymes, which are particularly susceptible to destruction by moist heat. The temperature may be raised without this danger after most of the water has been removed. In any event a definite diminution in the enzyme content always occurs however careful a control is maintained. Drying is usually complete in 3 to 4 days, when the grain is removed and the adhering rootlets, etc., blown off by means of fans. In plant where the drum process is employed drying is accomplished in the original container, which effects a saving in space and labour.

The Product

Malted milk is full-cream cow's milk combined with and modified by the nutritive extracts of malted barley and wheat, the water of the mixture being removed *in vacuo*, with the result that a sponge-like or foraminous substance is formed which is not a mechanical mixture of the various solids that enter into its composition, but each particle is a combination of the constituent materials.

A steam-heated mash tun.

Malted milk was the first commercial product to combine milk solids with an extract of malted cereals, so that the stability of the milk solids was maintained. In the United States of America the Federal Department of Agriculture has defined malted milk: "The prepared food known as malted milk is the product made by combining whole milk with the liquid separated from a mash of ground barley malt and wheat flour, in such a manner as to secure full enzymic action of the malt extract and reducing the mixture to dryness by desiccation; it may also contain added sodium chloride, sodium bicarbonate and potassium bicarbonate."

"The United States Federal standard provides that malted milk shall contain not less than 7·5 per cent. milk fat and not more than 3·5 per cent. moisture."* The Horlick's Malted Milk Company made the first successful attempt to embody whole milk in a product of this description which would keep indefinitely in any climate.

The Mashing Process

The malted barley, which should have a high diastatic capacity and be free from broken or foreign corns and culm, is crushed; not too finely, as this renders the removal of the husk more difficult on completion of the mashing process, and small pieces of husk might ultimately find their way into the finished product.

The resulting "grist" is mixed with a high-grade wheat meal or flour derived from good sound wheat having a low moisture content. An adequate supply of good water is necessary for the mashing process. The mixed cereals are mashed with cold water and the temperature is gradually raised, but at no time must it exceed 160° to 165° F. During the mashing process the whole of the starch is hydrolysed by diastase to maltose, dextrin and intermediate malto-dextrins, the relative amounts of these carbohydrates being accurately predetermined by the method of malting and the mashing technique. At the same time the complex cereal proteins are partially converted into simpler and more soluble protein substances by the action of the proteolytic enzymes. When the mashing process, which takes several hours, is complete, the insoluble husk residue is removed by passing the mash through a centrifugal separator. In this way the whole of the available extract is obtained.

Milk

It is important that the milk be fresh, and analytical control is essential to ensure uniformity of quality (consistent with certain well-known seasonal variations) in order to produce malted milk of standard composition. Milk reconstituted from

* *Condensed Milk and Milk Powder*, by Hunziker.

dried milk is not a satisfactory material for use in the manufacture of malted milk. Its use results in the production of an inferior article less pleasing and lacking in the essential properties associated with genuine malted milk.

Dehydration

The milk and the "wort", as the cereal extract is called, are mixed together in vacuum evaporators. When about a half to two-thirds of the water has been removed, the product is transferred to steam-jacketed evaporators having stirring gear attached. While dehydration is proceeding a high vacuum is maintained and the material is constantly stirred to facilitate the removal of water and to prevent excessive caramelisation. It is in this apparatus that the product is deprived of the remaining moisture and swells up to form a sponge-like or foraminous mass. In passing, it is interesting to note that Hartmann and Hillig, in "A Study on Malted Milk", say: "Genuine malted milk has well defined recognisable characteristics that differentiate it from other products of similar composition. These characteristics, it is believed, can be obtained only through evaporation *in vacuo* of the component parts . . ." (*J.O.A.C.*, xii., No. 2). It has been stated by some manufacturers that other methods of dehydration, such as the spray and roller processes generally used for milk drying, have been tried without success. When the latter methods of dehydration have been employed it has always been found that the product is characterless and the flavour pasty and doughlike or harsh.

During the dehydration process the milk fat is emulsified and evenly distributed throughout the mass in a very fine state of sub-division. The fat globules are thus insulated from the air and protected against chemical action which might otherwise be brought about by contact with atmospheric oxygen. The absence of an excess of moisture in the finished product, together with the fact that the manufacturing process is carried out *in vacuo*, also assists in preventing subsequent oxidation of the fat. It is undoubtedly due to these factors that malted milk possesses such remarkable keeping properties.

Finished Product

The sponge-like malted milk from the evaporator is finally reduced to powder and sieved to regulate particle size and density for convenience of packing into suitable containers. At this stage full precautions are necessary to guard against the possibility of the product absorbing moisture from the atmosphere. Malted milk is extremely hygroscopic, and if it absorbs any appreciable amount of moisture at this stage its keeping qualities will be seriously impaired. Malted milk freely dissolves in hot or cold water or milk in all proportions, yielding the palatable food drink possessing a very agreeable odour and flavour.

[The photographs illustrating this article are by courtesy of Horlick's Malted Milk Co., Ltd.]

The NUTRITIVE VALUE of MILK

(Continued from page 348.)

The Economics of a Milk Diet

Milk furnishes more of the substances essential for health than does any other article of the same cost. To reduce this problem to practical terms the daily food needs of a school-age child (10 to 12 years old) have been chosen as standard. A liberal amount of the essential constituents of such a child's diet is supplied by 1 quart of milk daily, and this is a satisfactory foundation on which to build up the rest of the diet. The daily diet of a child should contain the following foods, in addition to 1 quart of milk, if the diet is to be complete: Two or more kinds of fruit, one of which should be orange, lemon or tomato; two or more vegetables, one preferably raw (lettuce, etc.); one or more helpings of a high protein food (such as meat, fish, eggs or cheese); and one helping or more of bread. These are minimum quantities and the diet may be increased on this.

Milk has thus supplied the calcium; the fruits the vitamin C; eggs and green vegetables the iron; and meat, bread and eggs the phosphorus and protein. The health reserve of vitamin A is supplied by butter and the milk fat and by green vegetables.

On costing the above foods it is observed that 1 quart of milk costing 6d. has satisfied all of the child's need for calcium, has provided nearly all of the necessary vitamin A, has supplied nearly all the phosphorus, $\frac{2}{3}$ of the protein, and more than $\frac{1}{4}$ of the energy and $\frac{1}{6}$ of the iron, whilst to complete the above diet would require an *additional* 1s. 3d.

The large contribution made by the quart of milk compared with its fraction of the total day's outlay shows that the nutritive value of milk is unique and should be regarded as a fundamental article of the diet.

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Memorandum on the Nutritive Value of Milk

In connection with the article on "The Nutritive Value of Milk" we would remind readers that there was recently published a memorandum on the Nutritive Value of Milk issued by the Ministry of Health and the Department of Health for Scotland.

CAROTENE

by H. Stanley Redgrove, B.Sc., F.I.C.

The chemical constitution and properties of carotene, which is closely connected with vitamin A, are described, and reference is made to the use of commercially made carotene in place of artificial colouring matter in butter.

CAROTENE WAS first isolated from carrots, the roots of *Daucus Carota* L., by Wachenroder, well over a century ago. It is only within recent years, however, that the great importance of this substance in the economy of animal life was discovered, a discovery which has led to a thorough investigation of the chemistry of the substance.

Carotene is widely distributed in nature. Apart from carrots and sweet potatoes, the root systems of plants contain little or none of it, but it occurs in leaves, as well as in many seeds, fruits and flowers. It is also found in bacteria and in certain animal tissues, especially in the liver. Carotene forms ruby-red quadratic crystals, soluble in fats and fat-solvents. It gives blue colours with concentrated sulphuric acid and with antimony trichloride, and is the most important member of the group of plant pigments known as "carotinoids".

Connection with Vitamin A

As a colouring matter, carotene is of theoretical rather than of practical interest. The great significance of carotene for the food manufacturer arises from the close connection between it and vitamin A. About five years ago the work of Steenbock and his colleagues revealed a remarkable parallelism between the occurrence of this vitamin and pigments of the carotenoid class in plants; but the hypothesis which was tentatively entertained, that vitamin A was identical with carotene, was negatived by the fact that certain important animal sources of vitamin A, such as some grades of cod liver oil, were almost colourless, whereas even the minute quantities of carotene corresponding to the vitamin A content would have revealed themselves by their colour. Moreover, feeding experiments with carotene did not lead to satisfactory results. These experiments, however, were carried out at a time when the distinction between vitamins A and D was not thoroughly understood, and failure was due to an insufficiency of the latter vitamin in the diet.

Actually, recent work has shown that carotene is able perfectly to take the place of vitamin A dietetically, although the two substances are not identical. They are, however, closely connected in chemical constitution, and the animal organism is able to convert carotene into vitamin A. This vitamin is stored in the liver, and it is possible, though not certain, that the work of transformation is performed by this organ.

Chemical Constitution

Carotene is a hydrocarbon possessing the formula $C_{40}H_{56}$. On catalytic hydrogenation, eleven molecules of hydrogen are added, with the production of a hydrocarbon $C_{40}H_{78}$, which behaves as a fully saturated body. These facts indicate that the carotene molecule contains eleven ethylene linkages plus two rings. In view of its high colour it is safe to assume that the ethylene linkages are conjugated—that is to say, occur in the molecule alternatively with ethane linkages.

Properties

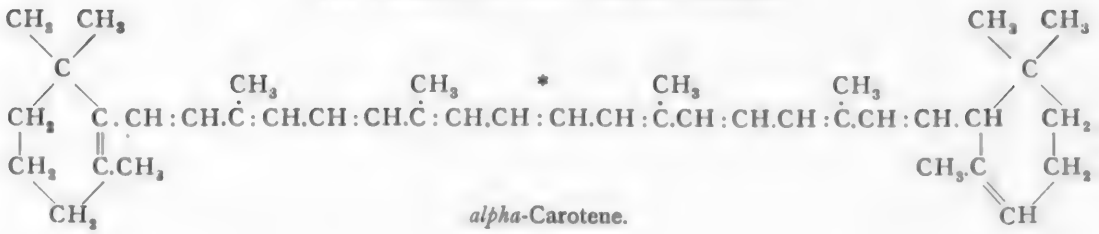
Oxidation with chromic acid yields six molecules of acetic acid; while, if permanganate is employed, which also produces acetic acid, the characteristic odour of ionone is developed, pointing to the presence in the carotene molecule of the ionone ring. Karrer and his co-workers have done much to clear up the chemistry of carotene, which is complicated by the fact that more than one isomeric carotene occurs in nature. Carotene of plant origin usually consists of a mixture of two isomers, distinguished as *alpha*- and *beta*-carotene respectively. The latter is usually present in larger amount, palm oil providing the most notable exception, and sometimes occurs alone. *alpha*-Carotene is optically active while *beta*-carotene is not. *alpha*-Carotene melts at 187° to 188° C., *beta*-carotene at 182° to 183° C. Ordinary carotene usually melts at lower temperatures, according to purity.

Separation of the two isomers is effected by means of differential adsorption by means of fuller's earth or magnesia. A third isomer, *gamma*-carotene, melting at 178° C., has been isolated from certain plant sources, while the existence of a fourth, *delta*-carotene, is indicated. Very significant, in respect of constitution, are the facts discovered by Karrer and his co-workers that *alpha*-carotene yields both geronic and *iso*-geronic acids on ozonisation, while *beta*-carotene gives geronic acid only.

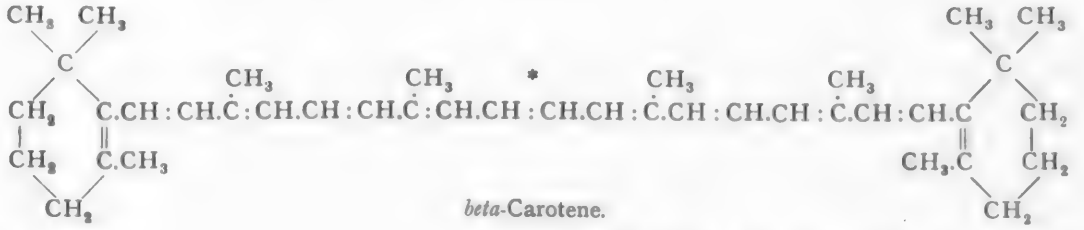
The behaviour of the two isomers in this and other respects is well explained by the formulæ proposed by Karrer, given on the next page, which are now generally accepted.

gamma-Carotene and *delta*-carotene probably contain only one ring system per molecule, while the isomer lycopene—the chief colouring matter of tomatoes—is an open-chain compound. Closely related to the carotenes are the xanthophylls. These are mostly hydroxy-derivatives of carotene. Some writers confine the name "xanthophyll" to the specific xanthophyll lutein, a yellow plant pigment.

THE FORMULÆ OF THE CAROTENE ISOMERS.



alpha-Carotene.

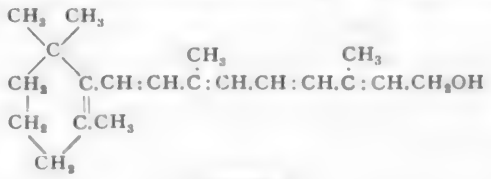


beta-Carotene.

Vitamin A

Although it is doubtful if vitamin A has so far been obtained in a state of absolute purity, its close connection with carotene, as already stated, is firmly established. The vitamin is an unsaturated alcohol, almost certainly possessing the formula $C_{20}H_{30}O$. Karrer has shown that, like carotene, it yields geronic acid on ozonisation, and hence contains the *beta*-ionone ring. Very significant is the fact that, although both *alpha*- and *beta*-carotene are able to yield vitamin A, the *beta*-form is twice as effective as the *alpha*.

There seems little reason to doubt that vitamin A results from carotene as a result of hydrolysis resulting in fissure at the ethylene linkage marked with an asterisk in the formulæ above. Adopting Karrer's formula for the vitamin, given below, it is obvious that, while the symmetrical molecule of *beta*-carotene is able to yield two molecules of vitamin A, only one can be produced from the unsymmetrical molecule of the *alpha*-isomer.



Vitamin A.

A comprehensive account of the chemistry of the carotenoid pigments, and of the connection between carotene and vitamin A, will be found in Dr. Harry Willstaedt's *Carotinoide, Bakterien- und Pilzfarben* (Stuttgart, 1934).

Carotene is easily oxidised; and it is possible that the part played by the carotinoids in the economy of plant life is that of oxgyen carriers. Carotene is rapidly oxidised by atmospheric oxygen if heated, but, on the other hand, well withstands the action of heat if air is excluded. This is a matter of great importance to the food manufacturer, since it follows that he is quite able to can goods which naturally contain carotene or to which carotene has been added, without detriment to the carotene, providing necessary precautions are taken.

Pure *beta*-carotene was adopted as international standard for vitamin A in 1934, 0·0006 mg. of this substance corresponding to one unit.

One method of estimating the vitamin A potency of various products is a colorimetric one based on the blue colour developed with antimony trichloride, added in chloroform solution. A description of the method as applied to cod liver oil is given in Appendix XIV to the current British Pharmacopœia. One drawback to this method is that the blue colour is also given by carotinoids possessing no vitamin value.

Physiological Effects of Vitamin A

Vitamin A has been called the anti-infective vitamin, since a defect of it in the diet results in a lowering of the resistance to infections, more especially of the respiratory tract; and one well-known firm which manufactures a standardised preparation of this vitamin claims that "early administration (of this preparation) in large doses as soon as the symptoms of a cold become manifest will often abort the attack entirely or at least reduce its virulence to a minimum". Lack of vitamin A also results in a peculiar disease of the eyes, known as "xerophthalmia".

Both xerophthalmia and decreased resistance to infection resulting from vitamin A deficiency appear to be due to keratinisation of the mucous membranes; and it is perhaps correct to state that the special function of vitamin A in the economy of the animal kingdom is to prevent this and other undesirable changes (hyperplasia and metaplasia) in the mucous membranes taking place.

Vitamin A deficiency also results in degenerative changes in the afferent fibres of the central and peripheral nervous system. It is associated with night blindness, and also with the formation of renal and bladder calculi. A good summarised account of the effects of vitamin A deficiency will be found in seventh edition of the Plimmers' *Food, Health, Vitamins* (London, 1936).

Carotene in Butter

It is of course a well-known fact that in certain districts there is a marked preference for butter which is highly coloured. It is held that such butter is more nutritious

than that which is pale in colour. This is an instance of a sound instinct, or, perhaps, it may represent the result of generations of experience; for, generally speaking, butter which is high in colour, providing this effect has not been produced by the addition of artificial colouring matter, is richer in carotene and has a higher vitamin A potency than pale-coloured butter. However, to meet the demand for high-coloured butter, the addition of various coal-tar dyes is commonly made, so that, in actual practice, the colour of butter provides no guide as to its vitamin value.

Although the coal-tar colours used for tinting butter may be quite harmless in themselves, they give to a public which has learnt to rely on colour as an index of quality a false impression. It therefore seems desirable that their use should be discontinued and carotene, which is now commercially available, employed in their place; for the addition to butter of carotene not only serves to heighten the colour, but at the same time increases the vitamin A potency.

There are other foodstuffs—for example, certain cheeses—in which the food manufacturer who is desirous of improving quality might legitimately incorporate carotene, more especially products normally rich in vitamin A but which, for any reason, are actually somewhat deficient in it. On the other hand, it is not desirable that carotene should be used indiscriminately or in excessive proportions. So far as possible, the addition of such a product should be standardised in order to maintain a reasonable vitamin A potency.

PLAY GOLF

ARRANGEMENTS are now nearing completion for the annual FOOD MANUFACTURE Golf Meeting. It will again be held in connection with the Imperial Fruit Show and Canners' Exhibition this year at Liverpool. Negotiations are proceeding with the Childwall Golf Club, easily accessible from Liverpool. It is a sporting but not too difficult course, suitable for the friendly nature of this competition, and the Club House is a fine old mansion converted.

The prize list so far is as follows:

FOOD MANUFACTURE Challenge Cup, with Replica, for the best net score.

Eburite Cup for the runner-up.

Prize presented by Maurice W. Batchelor, Esq., for the best net score, handicaps between 18 and 24.

Prize presented by Messrs. Brown and Rawcliffe for hidden nine holes.

Prizes presented by Howard Harding, Esq., for the first pair, four-ball bogey.

Prizes presented by Howard Harding, Esq., for the second pair, four-ball bogey.

There will also be a Cup for competition by members of the Can-Cans playing in the competition.

The arrangements will be as before: Morning round, stroke play. Afternoon, four balls against bogey.

The actual date has not yet been fixed, but by arrangement with the exhibition promoters it will probably be on Tuesday, November 3.

The arrangements are in the hands of Mr. W. Leonard Hill and Mr. Maurice W. Batchelor, and the local arrangements are very kindly being undertaken by Mr. Geo. T. Fitzpatrick.

The competition is open to everyone associated with the food business attending the Convention. Most of the previous years' competitors will again be playing, and all those who wish to enter this year are asked to write to FOOD MANUFACTURE, 17, Stratford Place, London, W.1.

This is not a "tiger" competition and full Club handicap is allowed; and there are prizes for all (or nearly all).

FLAVOURING ESSENCES

FLAVOURING essences were adequately represented at the Chocolate and Confectionery Exhibition, held at Olympia, London, from September 2 to September 10, firms exhibiting these being the British Essence Co., Ltd., Messrs. W. J. Bush and Co., Ltd., Messrs. Cooke, Tweedale and Lindsay, Ltd., Messrs. Polak and Schwarz (England), Ltd., and Messrs. Stevenson and Howell, Ltd.

In addition to well-known standard lines, such as Polak and Schwarz's now widely used Gooseberry Essence M., Cooke, Tweedale and Lindsay's Vanillot, and the latter firm's very nice Coconut Essence (of particular interest, as it is based entirely on synthetics), etc., other exhibits illustrated recent developments which reflect great credit on the manufacturers concerned.

The present shortage of Sicilian oils has been met by skilful blending, as evinced by orange oils exhibited by the British Essence Co., Ltd., and Messrs. Cooke, Tweedale and Lindsay. The walnut flavour has recently received increased attention, as exemplified by excellent walnut flavouring essences shown by Bush and by Polak and Schwarz respectively. The latter firm showed two distinct varieties, of which "M" is more pungent than "9". Bush's recent "L.J." essences for liqueur-centred jellies—a new and attractive form of sweetmeat—are of particular interest, and note should be made of the inclusion in this series of mulberry and sloe gin essences, as these are flavours hitherto neglected by the confectionery trade.

Among other exhibits representing recent forward moves, the following may also be mentioned: British Essence Co., Ltd.: a Nutty Cream Flavour in cream form, and Essence of Pineapple Comp., 1936; Messrs. W. J. Bush: Rum Essence, 1936, of different character from the firm's well-known Essence of Rum, Jamaica; Messrs. Cooke, Tweedale and Lindsay: Essence of Banana, 1936 "B", which gives highly satisfactory results in cream-centred chocolates, and a special essence for cough drops in which a cherry flavour has been used to disguise the medicinal taste; Messrs. Polak and Schwarz: Pear Essence L 1657, a new concentrated cherry essence, and acetyl methyl carbinol, a recently introduced substitute for diacetyl which has the advantage of being more stable to heat.

BOOK REVIEWS

Milk: Production and Control

The authors of this comprehensive treatise entitled *Milk: Production and Control*, have endeavoured to describe all the steps through which milk goes from its production by the cow until it is stored by the consumer. Every phase of milk production, handling and processing of liquid milk is dealt with in detail; the main theme of the book deals with the precautions which have to be taken to ensure a clean milk supply to the consumer. In the Preface a list of the classes of people interested in the handling and distribution of milk is given; the authors could with profit have included the dairy engineer in this list. Most of the 180 illustrations consist of portions of dairy processing plant, the products of the dairy engineers' ingenuity.

When reading the book one is at once interested to learn with what degree of expertness and completeness a medical officer of health and a sanitary inspector can deal with the composition, analysis and nutritive value of milk, the selection, management and feeding of dairy cows, the planning of cowsheds, the accurate control of milk pasteurisation and the economics of milk buying and retailing. The effort of the authors is to be commended from the point of view of giving general information to persons who are not cognisant with the problems of each branch of milk production and control and who have only a scanty knowledge of milk behaviour and properties, but the book cannot be recommended as a manual for the expert in any of these branches, except in the bacteriological testing of milk, perhaps. However, the books and pamphlets which have appeared on milk bacteriology are numerous and this book does not add to our knowledge of the technique, and there does not seem to be any reference to the search which is at present going on for new media and other conditions which are likely to give a more true count of the bacteria of milk.

Food chemists would have desired a fuller and more masterly treatment of the chemistry of milk. The subject, both as regards the composition and the nutritive value of milk, is skimmed over and none of the newer conceptions of the significance of milk constituents is described; the vitamins are merely mentioned. No attempt has been made to explain the significance of the various determinations in milk analysis; the methods given are somewhat out of date and attention should have been paid to newer methods. Four tests for heated milk (p. 435) are inadequately described and do not take into account the difference between milk heated to 145° F. and milk heated to higher temperatures. The description and causes of various milk taints are not altogether true, and some reported causes of taints which have appeared in many older books but which have since been found to be erroneous in principle are again reproduced here.

The idea of looking at the quality of milk only from the hygienic standpoint has been much to the fore during the last ten years, and no account is taken of the compositional quality of milk. Although a rough description is given of the causes of the variation of milk composition, the present position of our knowledge with respect to low solids-not-fat in milk has not been adequately reviewed; this would have been new information and helpful to both farmer and processor.

The fact that milk is an excellent medium for bacterial growth, whether of pathogenic or harmless bacteria, is again driven home. Milk is shown to be contaminated easily with almost every pathogenic organism known to medical science; if the theme of the book were not so pessimistic as regards the ills that milk is heir to, a better conception of the nutritive value of milk and its value in the nation's food supply would be obtained.

The description of the usual bacteria found in milk and the control of bacteriological milk quality in the laboratory is fully described. Voluminous information is given for every step through which milk goes, from milking conditions on the farm up to the testing of the cooled pasteurised milk in bottle.

From this book food technologists will learn how to overcome problems concerned with the bacterial spoilage of foods. The thoroughness with which pasteurisation methods have been applied to preserve the marketable value of a very perishable food article will serve as a guide to similar problems with other less perishable foods. For the overcoming of physical and other problems with regard to food preservation the expert will, however, have to look elsewhere.

W. L. D.

Milk: Production and Control. By W. Clunie Harvey, M.D., D.P.H., M.R.San.I., and H. Hill, M.R.San.I., A.M.I.S.E., M.S.I.A. Pp. viii+556. Price 21s. H. K. Lewis and Co., London. 1936.

Flavours and Essences

The blending of flavours and essences is a manufacture whose secrets are so closely guarded that publications on the subject are always perused with the closest attention. Such publications are extremely rare and then the matter which is broadcast often is of inconsiderable value.

M. H. Gazan's *Flavours and Essences*, which has just been issued, is a handbook of formulæ which covers essences for all flavouring purposes excepting boiled material and ethers for use with boiled sugar.

The first part of the book contains in alphabetical order the various essence and ether formulæ, and these are all built up from various bases (and/or extracts) whose blendings are given in subsequent pages. In his preface the author states that the technical conception of the book is to prepare every essence by mixing basic products that have been specially tested for the purpose. Each of the basic products possesses its own special flavour and may be very useful for adding to natural fruit juices both to obtain a more pronounced taste and to improve the concentration. Up to now no formula for fruit flavouring has been successful in this respect.

A point of commercial importance is that practically no expensive apparatus is required and all the flavours described are very highly concentrated, very soluble and do not contain any material that will undergo change.

To the reviewer the formulæ as presented appear somewhat complicated, inasmuch that no single essence can be tried out without first preparing several bases. Such a procedure may commend itself to some essence manufacturers, but the reviewer's personal experience with such preparations inclines him to the view that simplification is advisable. Without "proving the pudding by eating" a casual glance through the book shows that there is abundant matter which should be of value to the essence industry. In future editions it would be helpful to read the precise definitions of substances such as raspberry spirit and also to find reference to the latest solvents and their uses. It is surprising to note the absence of capronate in pineapple essences and that no mention is made of the higher aldehydes in connection with various fruit flavours.

H. M.

Flavours and Essences. By M. H. Gazan. Chapman and Hall. Price 25s.

Books Received

A third and revised edition of the *Manual of Modern Cookery*, by Miss J. Lindsay and Professor J. H. Mottram, has just been issued. This contains an extensive alphabetical list of contents and deals in its introduction with the principles of diet and nutrition, and for that reason should serve to educate those concerned in preparing meals to suit both the modern life and the epicurean.

Manual of Modern Cookery. By J. Lindsay and J. H. Mottram. New and Revised Edition. University of London Press, Ltd. London. 1936. 4s. 6d.

INDUSTRIAL NEWS

King George's Jubilee Trust

The first annual report, covering the period from the foundation of the trust in March, 1935, to the end of its financial year on March 31 last, has been published. The Administrative Council have allocated grants to various organisations amounting to £63,850, leaving a General Fund of £959,663. It will be remembered that the objects of the Trust are, in brief, to advance the physical, mental, and spiritual welfare of the younger generation, and the need for larger funds is shown by the fact that this year it has proved necessary to supplement the income of the Fund by a considerable encroachment on capital.

Imperial Fruit Show

Lady Maureen Stanley will open the Sixteenth Annual Imperial Fruit Show and Canners' Exhibition at the Renshaw Hall, Liverpool, on Friday, October 30. The exhibition, staged for the first time on Merseyside, will continue until Saturday, November 7. Prior to the opening ceremony, the Lord Mayor of Liverpool will entertain Lady Maureen to luncheon at the Town Hall.

Dairy and Ice Cream Show

Arrangements for next year's National Dairy and Ice-Cream Convention have now been decided upon at a joint meeting of representatives of the National Federation of Dairymen's Associations and the Ice-Cream Association. It will be held again at the Crystal Palace, London, the exhibition being open from Tuesday, January 26, to Friday, January 29, 1937.

Sugar Research in India

The Imperial Institute of Sugar Technology was formally brought into being on September 1, 1936, by the conversion of the Sugar Section of the Harcourt Butler Technological Institute, Cawnpore. Mr. R. C. Srivastava, Sugar Technologist to the Imperial Council of Agricultural Research, has been appointed as the first Director of the Institute. The teaching and the research staff consists, besides the Director, of about twenty members, of whom the more important ones are the three professors of sugar technology, sugar engineering and sugar chemistry, each assisted by an assistant professor, and the research physical chemist and the research biochemist.

A. A. Maytham Resigns from Dewey and Almy

It is with regret that his many friends will learn that Mr. A. A. Maytham is vacating the position of manager of Dewey and Almy, Ltd. We will miss his cheery company at the Food Manufacturers' Golf Federation meetings at the Canners' Exhibition, although we understand that he will be present at the coming Exhibition in Liverpool.

Mr. A. A. Maytham.

The following statement has been circulated among the members of the Dewey and Almy organisation by Mr. Charles Almy, Junr., Vice-President:

"You will be sorry to hear that Mr. Maytham has resigned as Acting Managing Director of Dewey and Almy, Ltd., and has requested that his resignation become effective upon the conclusion of the British Canners' Convention early in November. I am glad to say, however, that he has consented to continue to serve as a director.

"Mr. Maytham has been associated with our English company for over six years, during which period its sales have shown a phenomenal increase. The many friends he has made throughout our organisation will want to join in extending to him best wishes upon his retirement from active duties.

"Mr. H. H. Munro is leaving for England on October 17 and will be appointed Acting Managing Director in Mr. Maytham's place."

Polytechnic Courses

A course of lectures on Bacteriology with laboratory work are being given by A. Sciver, B.Sc., F.I.C., at the Battersea Polytechnic. The evening classes commenced on September 21.

The Chemistry and Microscopy of Food, Drugs and Water is the title of a course being given at the Chelsea Polytechnic. The session began on September 21, and the course comprises Food and Drugs, by J. E. Woodhead, B.Sc., F.I.C., Ph.C., and D. C. Garratt, Ph.D., F.I.C., and Bacteriology, by C. A. Ealand, M.A.

Mr. A. W. Culver

Vokes, Ltd., manufacturers of motor and industrial accessories, have just appointed Mr. A. W. Culver as sales manager. Mr. Culver was for seventeen years with the Cities Service Oil Co., Ltd., latterly occupying the position there of sales manager.

Vokes, Ltd., have recently made extensions to their factory at Putney in order to cope with considerably increased orders.

British Manufacturing Plant for Synthetic Vitamins

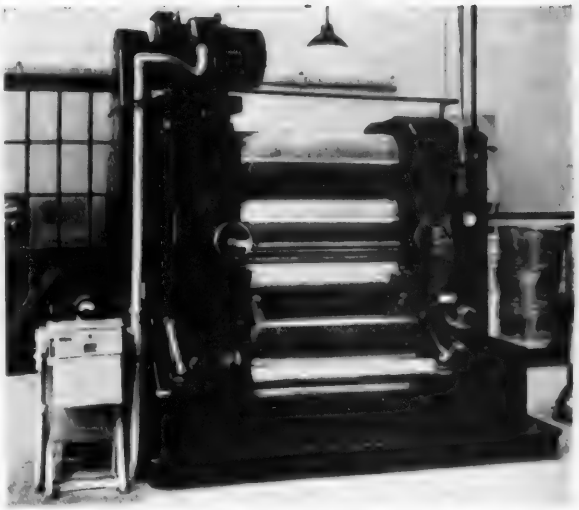
Roche Products, Ltd., have taken a five-acre site at Welwyn Garden City for the erection of new buildings, which will comprise one of the most modern chemical and pharmacological laboratories in this country. This British company is connected with the Hoffmann-La Roche Organisation, a combine of manufacturing chemists making more or less identical products in its own factories in eighteen different countries.

The most interesting feature of the new factory, which will produce a wide range of original medical products, is that it will be the first large-scale manufacturing plant for synthetic vitamins—in particular vitamin C. The principal patents for this, the first synthetic vitamin, are held by the Hoffmann-La Roche Organisation, and experiments suggest that synthetic vitamin C (issued under the trade-mark "Redoxon") is destined to play an important part in the solution of the problem of malnutrition.

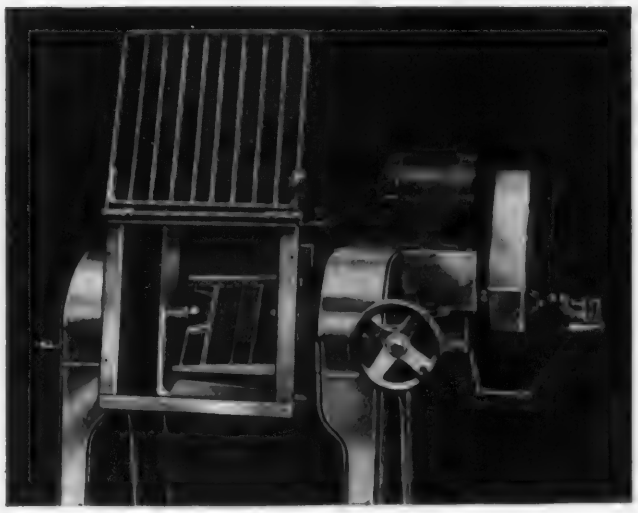
The interior and exterior designs for all the buildings are the work of Professor Salvisberg, who is one of the world's leaders in architecture and Professor at the School of Architecture at the University of Zurich.

Dublin Chocolate Factory Burnt Down

The Associated Chocolate and Confectionery Company's factory at Inchicore, Dublin, has been completely destroyed by fire. The damage has been estimated at £120,000, and considerable extra loss arises through the destruction of records of business in hand, and especially orders for this year's Christmas trade.



The Baker Perkins 5-roll Chocolate Refiner of new design which was publicly displayed for the first time at the Chocolate and Confectionery Exhibition held at Olympia from September 2-10. It embodies several new and patented features and gives a high output of very finely ground chocolate.



The "Maxima" High-Speed Dough Kneader shown on the stand of the Kneeda Manufacturing Co., Ltd., at the Bakers' and Confectioners' Exhibition held at Agricultural Hall, London, from September 5-11. It will make a dough in about 1½ minutes.

Food Firm for North Eastern Tradings Estates

The first firm to rent a factory on the new Government trading estate at Team Valley, Gateshead, is Messrs. Havemor, Ltd., who produce meat-pies and sausages. Starting in a small way at Westerthorpe, they have been so successful that plans are now going forward for national distribution of their products. The new factory of 7,600 square feet will be of light steel with glazed roofs—and will be surrounded by a garden. About fifty people will be employed.

New Bacon Factory

The proposal for the erection of a new bacon factory at Sunderland, Durham, has received the approval of the Bacon Development Board, and at the present moment a company is in course of formation for carrying out the project.

The building will cover two acres, and is to cost £30,000.

New Spray Process Milk Powder Factory

The Scottish Milk Powder Co., Ltd., of Kirkcudbright, Scotland, are erecting a second stainless steel Gray-Jensen Spray process plant in a new factory at Mauchline which should be in operation towards the end of this year.

It will be remembered that this company erected the first plant of this type in Scotland in July, 1935, for the production of Spray Process Milk Powder for sale in Scotland. Sales have been so heavy that the present factory cannot cope with the demand.

New Butter Factory

We understand that the Milk Marketing Board has accepted a tender for the erection of a new butter factory near Camborne, Cornwall. The factory will deal with about 12,000 gal. of milk daily and produce about 6,000 lb. of butter.

It is hoped the occupation will be available by December. In the meantime, the milk is being dealt with at the Helston factory.

Coleer Citrus Products Co.

The Coleer Citrus Products Co., 10 W. 47th Street, New York City, was recently taken over entirely by Julian S. Cohen, and the company will continue under the same name and at the same office.

The present plans call for doubling the capacity of the plant at Colton, California, and the company will continue to offer the trade its citrus products for the making of marmalade, bakers' supplies and various specialities, utilising Shredded Orange, Marmalade Base, Whole Crushed Orange, Orange Fruit Cells, together with similar products from Lemon and Grapefruit.

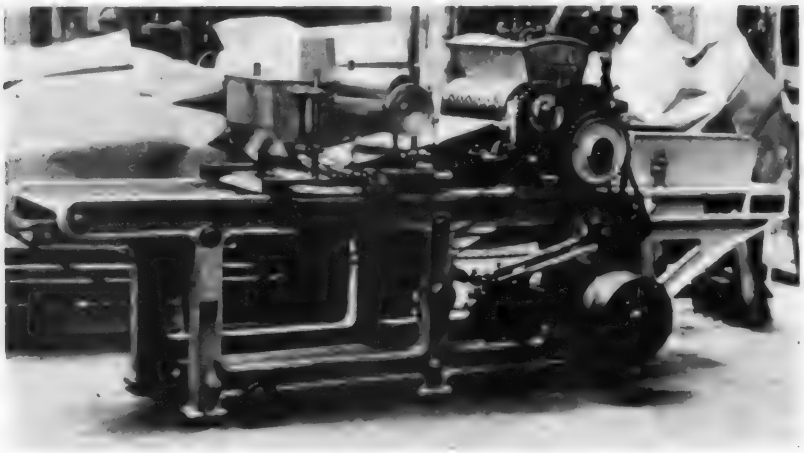
The company is also a distributor for several plants manufacturing domestic Peels in Brine. An additional line of all types of fruit juice will be offered the trade in the very near future. It is hoped that by the beginning of the year a new product of domestic origin but similar to the Spanish orange will be ready for sale.

Technical Books

The Phœnix Book Co., Ltd., have inaugurated a technical book service which promises to be of great value to the technical and professional man. As printed matter comes from the press, the company will look over it and keep the reader advised, free and without obligation, of that relating to his own specific interests. Coupled with this service there is a useful book-selling scheme. The books selected, whether listed in the company's bulletins or not, can be in the reader's hands by return, and payment may be made then or at any time up to eighteen months. A catalogue of new and standard technical and scientific books has just been issued by the company.

The "Rotap" Testing Sieve Shaker

The "Rotap" shaker manufactured by International Combustion, Ltd., employs a method of shaking sieves so that the tests will not vary from one to another. The machine is built for the use of 8-inch diameter testing sieves, and with sieves of standard height one sample can be tested on a series of six sieves of different openings (with half-height sieves, thirteen sieves of different mesh can be employed). By using pans with extended rims, three different samples can be tested at one time with standard sieves and seven with half-height sieves. The "Rotap" reproduces the circular and tapping motion given to testing sieves in manual testing, but with a uniform mechanical action. The shaker will work on either A.C. or D.C. electric supply for a power consumption of ¼ h.p. A time switch is used to eliminate errors in timing.



This new movable French biscuit machine, referred to on this page, permits the moulding of biscuits of any shape.

New Movable Biscuit Machine

An interesting machine which permits the moulding of biscuits of any shape and presenting any desired relief is being marketed in France. It has the additional advantage of being movable, so that it can be pushed out of the way after use, an advantage which may be very appreciable in a bakery in which the machine may be in use only a part of the day.

It consists of a frame near the centre of which is a hopper arranged with cylinders below it. One of these cylinders is the mould and contains a certain number of impressions of the form desired for the cakes. The dough placed in the hopper is pressed into these impressions by cylinders, which knead the dough slightly and force it well into the holes. As it turns, the superfluous dough on the upper surface is scraped off so that the cakes of exactly the form of the impressions are left.

These fall from the openings on to an endless belt in canvas, arranged near the moulding cylinder. As this belt carries the cakes along, they pass under a brush which, by means of a pair of cylinders, is slightly moistened with a solution of egg white to make them brown. At the same time a second endless belt running under this section of the apparatus carries along the pans on which the cakes are to be baked. The speed of the two belts is arranged so that as the cakes fall off the first belt on to the pan, the pan moves along a sufficient distance to spread the cakes evenly over the surface.

New Water-cooled Ozone Generator

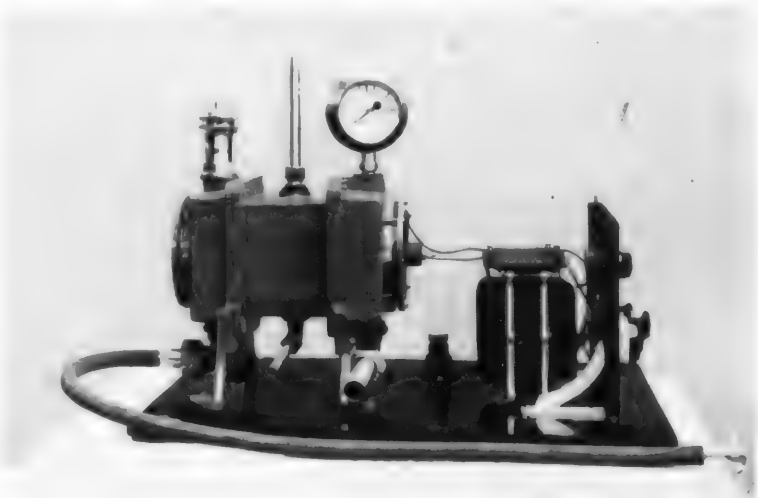
It is known that ozone is a most powerful oxidising agent, having the advantage of leaving no troublesome residue when its action is completed. A new water-cooled ozone generator, made by the Salisbury Transformer and Electrical Co., Ltd., is therefore of interest. The generator delivers the ozone under high pressure and in high concentration. It is advisable to use cold brine as the cooling agent for the highest concentration of ozone, although a tank of water suitably connected or the public water supply would suffice for lower concentrations. With air pressure supply, the output of pure ozone is 0·67 gm. per hour, and with oxygen supply 2·0 gm. per hour. The machine has a current consumption of 20 watts. The company makes ozone generators up to any desired output, either water or air cooled.

Air Pre-heaters for Boilers

The efficiency of a boilerhouse depends almost entirely on the temperature at which the flue gases leave the boilerhouse. With no economiser fitted the temperature of the gases leaving a Lancashire boiler may be anything from 600° to 900°, representing a large amount of waste heat. The "Meldrum" air preheater, made by Meldrums, Ltd., consists of a series of pipes through which the boiler flue gases pass. The air for combustion is blown by forced draught fan round and amongst these tubes and is then delivered to the stokers by sheet steel ducting. Both air and gases make two passes of the heater, the air horizontally and the gases vertically. In the case of an installation of two Lancashire boilers fitted with the air pre-heaters and "Meldrum" sprinkler stokers, the saving, represented by the improved efficiency and the cheaper fuel which can be used with this combination, is claimed to be more than £2,000 per annum.

Packing Samples and Specimens

A new outfit for filing and transporting samples and specimens has been put on the market by the Chemical Publishing Co. (New York). It consists of a black bakelite case containing 56 vials ($2\frac{1}{2}$ in. × $\frac{3}{4}$ in.) of plastic hycoloid, capped with aluminium. All components are said to be unbreakable, water- and oil-proof, soil-proof, and much lighter in weight than glass vial sets. No labels are required, it is only necessary to write on the aluminium cap. It is suitable for chemicals, etc., and the set is compact and easily carried.



Water-cooled ozoniser, with casing removed, made by the Salisbury Transformer and Electrical Co., Ltd. An adaptor for an oxygen cylinder is shown.

TRADE LITERATURE RECEIVED

The new "Palm" Toffee factory, at Acton, London. It works on the straight line production method, that is to say the butter, sugar, glucose, milk and so on go in one end, and the finished article comes out the other. Every process can be watched by onlookers who walk the "Captain's bridge" which runs the length of the building.

Electric Furnaces

A new brochure has been issued by Wild-Barfield Electric Furnaces, Ltd., dealing with their "Heavy-Hairpin" and "Tubular-Hairpin" furnaces. Details are given of the design and construction of the furnaces, replacement of the elements, forced air circulation, automatic temperature control, time switch, atmosphere control, etc. The makers will be pleased to send a copy of the brochure to any reader on application.

New Conveyor Chain Lubricator

C. C. Wakefield and Co., Ltd., have issued a leaflet describing a new conveyor chain lubricator, which is a compact self-contained unit, with the additional advantage of being highly efficient, low in price, and easily installed. In action, the rollers on the conveyor chain actuate a pump plunger projecting through the base of the lubricator, and oil is fed directly to the roller pins. The oil outlets are adjustable and are set in relation to speed and size of chain. The amount of oil delivered can be simply adjusted and the lubricator can be rendered inoperative and free of the chain when not required.

Stainless Steel Manipulation

A new catalogue devoted exclusively to the manipulation of stainless steel and entitled "Stainless Steel Manipulation" has been produced by G. Hopkins and Sons, Ltd., of Holloway Road, London. The catalogue has been excellently produced and contains a number of illustrations of the stainless steel equipment made by this company, much of which is of direct interest to the food industry. Views are given of a "Spray" type milk powder plant made from "Hopkins" "Staybrite" stainless steel, as well as many types of tanks, pans, transport tanks, tipping and straining chutes, buckets, etc.

Production Indicators

Production Indicators, Ltd., have issued a leaflet describing an indicator, which they manufacture, showing the relation between actual and scheduled production at any period of the working day. The indicator consists of two units—the operating unit and the indicator unit. The former has an operating dial of the automatic telephone type, enabling the operator to dial any predetermined number. It can be arranged, where desirable, for the machine actually engaged in the operation to record its output mechanically. A red lamp lights up when production lags, and a green one when the output is up to or in advance of schedule. The indicator unit consists of a dial and two pointers—black, actuated by the master clock and registering estimated output, and red, operated from the operating unit and indicating actual output.

New Label Paster

The Alsop Engineering Corp. (New York) has introduced a new label paster which is claimed to put glue on labels at the speed of $\frac{1}{10}$ sec. for a 2-in. label, $\frac{1}{8}$ sec. for a 3-in. label, and $\frac{1}{3}$ sec. for a 6-in. label. Oil-less bearings are used on all shafts, all parts are interchangeable, and those touching the glue are made of rustless metals, such as stainless steel and aluminium. The thickness of the glue applied to the labels can be controlled to less than 1,000th of an inch by an adjustable thumbscrew.

The Crittall Cooker

This is the title of a well-produced catalogue issued by Richard Crittall and Co., Ltd., giving details of their cooker, which burns coal and yet keeps clean. The catalogue is fully illustrated and shows many of the types of cookers made by this company.

Tool and Die Steels

Thomas Firth and John Brown, Ltd., have published a catalogue describing the tool and die steels made by the company. These comprise carbon tool and die steels, high speed tool steels, alloy tool and die steels, steels for die blocks and special steels for special purposes. A supplementary pamphlet gives indications as regards the hardening and tempering of the steels.

Bausch and Lomb Optical Co., Ltd., has moved to Africa House, Kingsway, W.C. 2, where in addition to the offices, a complete display of Bausch and Lomb instruments is maintained.

Automatic Pressure Processing and Cooling

A new and well-produced catalogue, entitled Automatic Pressure Processing and Cooling, has been issued by L.C. Engineering Supplies, Ltd., of New Malden, Surrey. The catalogue deals with the Automatic Pressure Retort made by this company, which is simple in construction, small in bulk and economical in purchase. The second half of the booklet deals with the L.C. Cooling Tunnel, which is a device for the cooling of cans, bottled fruits, milk, or any other container requiring to be cooled. The catalogue, which is excellently produced, contains a number of full-page illustrations of the plant, while there are also explanatory diagrams which should be of considerable value to the reader.

The Methylene Blue Reduction Test in the CONTROL of MILK SUPPLIES

In view of the fact that, after December 31 next, the present method of prescribing the bacterial standard by the "plate-count" method (with a maximum limit of 200,000 bacteria per ml.) will be superseded by a colour test, as recommended in the recent report of the Medical Research Council, this article by RALPH G. HARRY, A.I.C., A.C.I.C., F.R.M.S., has particular interest.

Apparatus used for the Methylene Blue Reduction Test.

WHEN A small quantity of a dilute solution of methylene blue is added to milk, the colour of the dye is gradually discharged and the milk reverts to its original colour. Fresh milk, free from dissolved oxygen and held in contact with such a solution, will reduce it under strictly anaerobic conditions within 2 hours, but under ordinary circumstances this reaction is opposed by the free oxygen present and does not occur until the natural reducing power of the milk is reinforced by bacterial action.

The majority of organisms present in milk are capable of altering its oxidation-reduction potential to a point where the colour of certain dyes is discharged. This rate of alteration of potential varies considerably and is related to the "species", activity and rate of growth in a milk medium at any particular temperature, but in general it may be assumed that the time required for reduction decreases with increasing number of organisms.

Some 50 years ago Duclaux[1] observed that on adding indigo carmine to milk and then incubating it, it was decolourised. Neisser and Wechsberg[2] (1900) realised the value of this test for estimating the quality of milk and proposed the use of methylene blue. A number of dyes have since been examined for use in its place, but with the possible exception of Janus green[3] no dye has yet been found suitable; the majority of those examined possessing an oxidation-reduction potential which was either very high or, alternatively, very low, its reduction then taking place either with extreme rapidity or with excessive slowness.

It is assumed that the prescribed conditions for carrying out this test, when published, will closely follow the recommendation made by Professor Wilson and his co-workers in his report to the Medical Research Council, and therefore before further discussing this a résumé of the recommended method will be given. Emphasis is laid upon the necessity of using a standard methylene blue, and standardised tablets each containing a definite amount of the dye and ready for dissolving in sterile distilled water may now be obtained.

Modified Method Recommended for the Performance of the Methylene Blue Test.—1 ml. of a 1/30,000 solution of methylene blue is added to 10 ml. of the sample contained in 6 × ⅝ test tubes (previously sterilised), corked with a rubber cork (sterilised before use by immersion for 5 minutes in boiling water), the tube inverted once and immersed in a water-bath maintained at 37° to 38° C. by means of a thermo-regulator. (In the case of pasteurised milk an additional bath at 55° or 65° C. may be used.)

Light must be rigorously excluded by means of a closely fitting cover, since Whitehead[5] has shown that light catalyses a mechanism involving unsaturated fatty acids and the reduction of methylene blue, even in the absence of bacteria. The tubes are inverted at half-hourly intervals in order to distribute the organisms and fat evenly throughout the milk and the colour noted. Complete decoloration, or decoloration up to 5 mm. of the surface was regarded as the end point.

Interpretation of the Test

Barthel and Jensen, by the use of this test, have suggested four classes of milk, and give the approximate numbers of bacteria to which these reduction times approximately correspond.

Lockhead has suggested the following probable keeping quality of milk in hours:

Class of Milk.	*Reduction Time.*	*Approx. Keeping Time in Hours.*	*Approx. Corresponding Number Bacteria per Ml.*
Good milk ...	5½ – 9 hrs.	40	500,000 or less
Average milk ...	2 – 5½ hrs.	30	500,000 - 4,000,000
Bad milk ...	20 mins. – 2 hrs.	10	4,000,000 – 20,000,000
Very bad milk ...	20 mins. or less	less than 10 hrs.	20,000,000 or more

Mechanism of the Test

Barthel suggested that the test involved (*a*) the exhaustion of the dissolved oxygen by bacteria, which permitted the natural reductase of the milk to function, and (*b*) the reduction of the dye by constituents of the milk naturally present. Decoloration of the dye is assumed to result from the addition of hydrogen, but the actual mechanism of this reaction is still a matter for dispute.

When agar impregnated with methylene blue is inoculated on its surface the destruction of the colour is not confined to the vicinity of the colonies, and this would suggest that the active agent was some diffusible product of metabolism, but attempts to isolate such a product from cultures have proved fruitless. The evidence suggests that an enzyme system is in operation, but whether the reducing system is furnished by the milk, by the organisms, or whether by both is a moot point.

The exhaustive investigations of Professor Wilson and his co-workers have made it evident that the exact mechanism is extremely complicated, and it is possible that four different reducing systems are present in milk independent of the presence of bacteria.

The first is present in raw milk and is capable of reducing methylene blue only under anaerobic conditions; the second is present in raw milk and is capable of reducing methylene blue aerobically in the presence of formol; the third, present in autoclaved milk, is revealed under anaerobic conditions, but which, when very active, may reduce methylene blue aerobically; whilst the fourth is present in both raw and boiled milk and active aerobically in the presence of light.

The reductase test is therefore ***a measure of the total metabolic activity of the bacterial flora***, the actual part played in any "particular" sample by the natural reducing system present being of no actual *practical* importance.

Significance and Use of this Test

Neither raw nor pasteurised milk ever reduces methylene blue under aerobic conditions in the absence of bacterial activity, so that this test is definitely an index of such activity.

In its proper sphere this test is of the greatest value, since it is simple to perform and inexpensive. Moreover, Hiscox, Hoy, Lomax and Mattick[4] indicate that a close correlation exists between the appearance of taint, as indicated by taste, and the discharge of methylene blue, which would have the advantage in eliminating the personal factor and peculiarities in taste and at the same time offer observation in much shorter periods than usual.

The results of this test must not be interpreted in the terms of the usual plate-count, as the two tests measure two entirely different things. The plate-count gives information as to the number of bacterial organisms and clumps in milk, whereas the reductase test is a measure of their "activity".

Criticisms of the Test

It has been claimed that the new test, as modified, is suitable for the grading of good quality milk, such as Certified, but the results in this report do not justify such a claim. We find[5] that 67·8 per cent. of churn milk and 61·9 per cent. of rail-tank winter milks giving plate-counts of 30,000 to 200,000 bacteria per ml. did not reduce methylene blue in 6 hours and that 24 per cent. and 10·7 per cent. did not reduce it in 8 hours. This means that under ordinary laboratory conditions overtime would continually be in force if milk of high quality was to be distinguished by this test. Further, it is stated[7] that 30 per cent., 16 per cent., 35 per cent., 38 per cent. and 28 per cent. of samples of milk with plate-counts of 200,000 to 1,000,000 did not reduce methylene blue in 6 hours, and hence a large number of samples with a very high plate-count could be passed by this test. Whilst I am of opinion that there is no evidence to show that milk of such a high count is any more harmful to the human organism (in the absence of definite pathogenic bacteria) than milk of a lower count, I believe that the highest possible standard of cleanliness should be encouraged, and I doubt whether this test will accomplish such a purpose on its own.

Professor Julian Huxley, addressing the conference of the Institute of Public Administration recently at University College, Oxford, quoted a correspondent of his (a dairy farmer) as stating that after deliberately contaminating a pint of his milk with a teaspoonful of stable manure, it still passed the reductase test. No reliance can be placed upon this unsupported statement, but in view of the publicity given to such a statement I have recently examined a number of samples before ***and*** after contamination in such a manner, by both stable manure and human fæces, and find it entirely without foundation. As a matter of interest one example may be given. A sample of raw milk upon examination required 7 hours for decoloration after contamination as above, and re-examining after 1 hour the time required for reduction was reduced to only 2 hours, whereas on allowing 5 hours to elapse before re-examination the time was reduced to a mere 30 minutes. Both of these times would be sufficient to indicate a bad milk.

It is true, however, that 10,000,000 organisms of the coliform group may be added to a very good milk without bringing it unduly under suspicion, and in this case I have investigated the addition of approximately such a number of the following organisms: *B. coli communis*, *B. coli communior*, *B. cloacæ*, *B. neapolitanus*, *B. acidi lactici*, *B. lactis aerogenes* and *B. oxytocum*. In actual practice, however, such contamination would be ade-

(*Continued on page* 375.)

E. B. Bennion, M.Sc., A.I.C., describes the—

BAKERS' EXHIBITION, 1936

THIS YEAR'S Bakers' Exhibition has been generally declared as good as, if not better than, any of previous years. In coming to such a conclusion, however, it is necessary to take an analytical view of the exhibition as a whole and not be influenced unduly by the general glamour and excitement which always prevails during the show itself.

Machinery Exhibits

There is no doubt that never before has there been such a good display of bakery machinery, nor has there ever been such evidence that "finish" is commanding the attention of all manufacturers. This year there were several new exhibits of bakery machinery, and there is no doubt that it is due to increased competition that all manufacturers are finishing off their machines in such an attractive manner. The newer machines for cake-making have embodied in them all the good points of the older machines, so that mechanical perfection, as well as utility, is an established attainment.

For bread-making plant two semi-automatic units were on show by Baker Perkins, Ltd., and Pelkman Bros. The plant by Baker Perkins was modern in every way, even introducing stream-lining in the design of the overhead power, whilst the new divider possesses almost the same qualities in design and action. Dough machines are being made by an increasing number of firms. The open pan mixer is predominant: the rotary mixer is almost a thing of the past. A new type of guard suitable for the fencing of double arm open pan machines was demonstrated on the stand of the Ellerstyle Engineering Company. This type should prove very effective in preventing accidents. Modern dough-making demands the open pan type of machine, first of all because of the character of present-day flour, and, secondly, because of the need for watching a dough during making in order to obtain the maximum water absorption for each type of dough. Manufacturers are to-day catering for these requirements well. The installation of a ventilating plant on the stand of Baker Perkins provided a most delightful breath of fresh air. We hope, however, it is also an augury of the development of air conditioning plants in bakeries in the future. The roll-making plant of the Humidor Company aroused interest, particularly the ciné film, which was shown at intervals during the day. With the growth of the Vienna roll trade the introduction of machines for making fancy shapes such as Kaisers and Crescents is a logical development as a means of making the production of fancy shapes a commercial possibility in many businesses. The hot air hand drying machine on the stand of the Lancashire Dynamo and Crypta, Ltd., among their wide range of cake and other machines for the caterer, attracted much attention. In view of the difficulty encountered in all bakeries in maintaining satisfactory supplies of towels, this machine should find a wide opening, particularly because of its relative inexpensive nature. Any bakery which aims at hygienic production and also at the prevention of dermatitis cannot afford to overlook such a machine.

Pie-making machines attracted much attention, since this branch of the trade is expanding constantly. Electric delivery trucks occupied a very important place in the Gilbey Hall, and again these claimed much attention. There are indications that the manufacturers are giving much more attention to the construction of batteries which will stand up to the wear and tear required, and also permit of as wide a working radius as possible without danger of overload. As yet it seems that such vehicles are only suitable for relatively flat districts; for hilly districts the petrol engine meets the demands most satisfactorily.

New Processes

During the exhibition there was considerable talk of a new process for improving the baking quality of flours, particularly certain grades of Canadian and Australian. The basis of the process is steam treatment of flour by means of atomised steam. During this process it is claimed that some of the starch granules are cracked so that extra moisture can be carried by it.

The writer also came across another new process for producing bread direct from the wheat. The basis of this idea is that first of all the outer portion of the bran is removed and then the remaining portion which constitutes 95 per cent. of the berry is reduced and made into a dough by a continuous series of operations, the wheat being steeped first of all. The fermenting agent is added afterwards. A sample of bread produced by this process was by no means unattractive and resembled wholemeal without the branny particles. In France this bread is proving popular.

A further new invention propounded was the reduction of wheat to flour in one single operation, with the production of a high extraction of good white flour. First of all a machine is designed to remove the bran, and this leaves the berry in its normal shape, resembling unpolished rice in appearance. From this grain the flour is ground. This flour possesses remarkable absorption properties, so it is claimed. It seems that if this idea is developed—and it is likely that such a unit is to be erected in Paris in the near future—the larger baker may become his own miller, producing a grade of flour to suit his own trade. It will be a return to ancient practice, although it may be hailed as a modern development. By such a process a wide range of flour of various definite extractions can be produced.

Finish or Flavour?

The special exhibit of bread and confectionery from America was not given as much prominence as it

deserved, but even so it aroused great interest. The average British confectioner has become such a slave to "finish" and external appearances that unless a cake comes up to his preconceived ideas it is looked upon with very critical eyes and often damned with faint praise. Such was the case with the American cakes. They possessed none of the usual British finish. There was no attempt at ornamentation. As a result there were those who consequently were prepared to pass them over lightly until their attention was drawn to the eating qualities. Then they went away thoughtful.

These cakes were flavoured and coloured with real fruit juices. The icings contained fruit juice—they were most delightful to eat. The chocolate cake tasted of chocolate. The lesson to the British confectioner should have been obvious. Make the insides of your cakes like these and apply some of the artistic skill to exterior decoration, and the result will be cake with palate and eye appeals which will prove the salvation of the British confectionery trade, for some salvation will be necessary if home baking is to be countered. These cakes were America's answer to home baking.

Competitions

The entries in all the confectionery exhibits were down and the standard not up to the previous high standard, taking the classes as a whole. There were many very good individual exhibits, and those of Messrs. Waterfield, of Derby, which won for them the Championship Cup, were in this class. Their decorated cakes were most beautifully designed and executed.

Among the bread exhibits there were many good specimens, and on the whole there was a greater tendency to find bread with more commercial potentialities on the shelves and in the prize case than for some years. There were cases of doubtful judging, but this is always so, particularly becoming apparent when the bread is seen a day or so later. Taking the bread entries as a whole, it can be said that "Best" bread was distinctly better.

The series of lectures on Sales and Shop Window Display for women were well attended and much valuable information was given. From the list of lecturers engaged this was vouchsafed.

The Millers' Mutual Advertising occupied a valuable position, and during the week great interest was shown in their stand, particularly with regard to the model mill of Mr. J. Prior of Spillers, Ltd., Birkenhead. There seems very distinct evidence that this campaign is bringing about an improvement in bread quality all over the country. Whatever else may be or have already been achieved, this first tangible result is most important.

The Methylene Blue Reduction Test in the Control of Milk Supplies

(Continued from page 373.)

quately determined by the use of the *Bacillus coli* test, which is to be continued in its present form.

Summary and Conclusions

The temperature at which the milk is held—viz., 37° C.—is not the optimum growth temperature for all the species of organisms found in milk, and consequently the reduction time is not necessarily a true indication of the activity of all the organisms present. Johns[8] has drawn attention to this fact, and suggests that the organisms which grow at the temperature of domestic storage are most important and suggests that the temperature should be 12·8° C. (55° F.). This would be more suitable for analysts—an important practical point.

Moreover, in spite of its improvements the reductase test cannot be recommended as yet as a sole basis for payment on hygienic quality, as it fails to distinguish the higher grades of milk, and for such milks the continuation of a plate-count, even if in addition, would be an advantage. Moreover, the preliminary incubation introduces a quantity just as variable as the error in the plate-count itself.

At the same time, the reduction of methylene blue under the conditions specified offers a simple and inexpensive measure of non-specific bacterial growth in milk, and there appears no reason why it should not supplant the more expensive plate-count method in those milks containing more than 500,000 bacteria per ml. It should certainly be useful in the control of milk supplies where it is desirable that the quality of the sample should be known within a few hours of its delivery at the factory. The test is valueless, however, for autoclaved or sterilised milk, since sufficient reducing activity may be acquired to cause reduction in a milk that, bacteriologically, might be sound.

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[6] Prof. Wilson, M.R.C., *Bact. Grading of Milk*, 1935, Table clvii, p. 345.
[7] Prof. Wilson, M.R.C., *Bact. Grading of Milk*, 1935, Tables cliv and clv, p. 341.
[8] Johns, *Sci. Agriculture*, 1930, ii, 171-90.

TOFFEE AND CARAMEL

We are informed by Robert Kellie and Son, Ltd., that the Toffee Pan illustrated on page 322 of last month in connection with the article by D. W. Grover on "Toffee and Caramel" was actually made by them and not by the Morton Machine Co., as incorrectly indicated.

INFORMATION and ADVICE

Dripping Manufacture—Refrigeration of Glacé Cherries—Processing of Tinned Hams—Mint Sauce—Vegetable Extracts—Jam Manufacture—Potato Flour in Bread—Liquid Vegetable Cream

Dripping Manufacture

2,039. *We are interested in the production of dripping, and if you can give us any information regarding the manufacture of this product we shall be grateful.* (Enniscorthy.)

This can be done in a variety of ways, using either gas heating or steam.

On a small scale the fat is first chopped up and placed in a wire gauze basket in a steam tank, into which steam is passed; the rendered fat falls into a lower chamber with any condensed steam; this melted fat is drawn off and boiled with water and allowed to cool on the top of the water; this water is then drawn off and the fat melted again and filtered to remove any foreign matter; it is then poured into moulds and allowed to cool.

This method can, of course, be elaborated, but care must be taken not to overheat the fat, otherwise discoloration will take place.

The type of fat used will also influence the finished product. If very soft beef fat is used, the resulting product will probably be too soft. It is therefore advisable to use a mixture of the harder and softer portions of the fat mixed together. Mutton fat can be rendered down in the same way, but it is inadvisable to mix beef and mutton together unless it is to be sold without any special designation.

Refrigeration of Glacé Cherries

2,040. *We wonder if you have any information on the refrigeration of glacé cherries and could give us some hints on the best methods to use, including temperatures and the question of humidity should it arise in this particular problem.* (England.)

Assuming that the syruping has been effectively carried out, glacé cherries do not require any very special treatment during refrigeration. It is usual to store this type of product at about 30° F., but owing to the high concentration of sugar, the exact temperature is not nearly so critical as for fresh fruit and vegetables. The relative humidity should be controlled to about 85°; if it falls much below this, the cherries tend to become hard and a certain amount of shrivelling takes place. On the other hand, if it is much higher, there is the risk of a deposition of moisture on the surface and liability to mould growth.

Processing of Tinned Hams

2,041. *We will be very pleased to hear from you regarding the processing of tinned hams, giving the times of cooking and temperatures.* (Manchester.)

There appears to be no definite ruling regarding the processing of hams, each manufacturer having his own particular process, which, of course, is kept secret.

We understand, however, that the usual temperature is 184° F., and for hams weighing from 10 to 12 lb. 4½ hours is usually allowed; 12 to 14 lb., 5 hours; 14 to 17 lb., 5½ hours; 18 lb., 6 hours.

Mint Sauce

2,042. *We should be very much obliged if you could give us some information regarding the preparation of mint sauce from English mint on a commercial scale.* (Sheffield.)

For many reasons it is preferable to use dried English mint for making mint sauce commercially, otherwise a whole year's pack has to be put down during the season, and it should be treated as follows:

Wash in two changes of water, draining the washing water from the mint by means of fine sieves. A third washing should then be carried out with water to which 5 per cent. of acetic acid has been added. The treated mint is then pressed between rollers and filled into bottles, about one-third of the total volume of the bottle being occupied by the mint. The bottles are then filled up with hot No. 3 malt vinegar at 175° F., and corked. It is not usual to add any sugar to the vinegar as this increases the risk of spoilage and tends to cause the formation of a haze. If it is desired to start straight from fresh mint without previously drying, this can easily be done by finely chopping the mint after washing and then treating with water containing 5 per cent. of acetic acid as above, and then following the process as for dried mint.

Vegetable Extracts

2,043. *We should appreciate it if you would forward information on the manufacture of vegetable extracts.* (Australia.)

Within recent years vegetables and yeast have been used extensively for the manufacture of extracts, which resemble meat extracts in appearance and taste, but which differ from these in that they do not contain any creatine or creatinine.

Many different processes have been evolved and many patents taken out for the production of vegetable extracts from waste or surplus vegetable material. Most of the processes for making yeast extract depend upon a partial digestion of the cells by the enzymes of the yeast (autolysis). In this process the dried yeast is usually ground to rupture the cells as much as possible so as to liberate the enzymes, and then it is allowed to autolyse with the addition of a small amount of a suitable preservative, such as SO_2, in order to prevent putrefaction.

The autolysed yeast is then extracted several times with hot water, the extract being separated from the cells either by centrifuging or by settling and running off the supernatant liquor.

The collected extracts are then evaporated in an open jacketed pan (or preferably a vacuum pan) until a semi-solid mass results. The requisite amount of salt should be added when partially evaporated.

If an open pan is used to evaporate the extract, the final product will produce a cloudy solution due to the fact that some of the protein has been coagulated or denatured. On the other hand, if the evaporation is carried out under vacuum this is prevented, and a much better and more soluble extract results.

Often, for vegetables and yeast, the material is merely boiled with successive quantities of water, and the collected extracts treated as described.

Other processes involve the partial breakdown of the vegetable tissues by boiling (preferably under pressure in an autoclave) with dilute hydrochloric acid. This operation achieves a similar result to the autolysis described for yeast. After extraction with two or three changes of water and finally pressing, the collected extracts are mixed and made neutral by the addition of the calculated quantity of caustic soda. In this way common salt is formed in the extract, as a result of the neutralisation, and this obviates the necessity of adding salt after the evaporation.

Jam Manufacture

2,044. *We are going to undertake the manufacture of jam and should be glad of any information you are able to furnish regarding the following points:*

Quantity of sugar to be used for every 80 lb. of fruit pulp.

To what temperature must the fruit pulp, and later the mixture of pulp and sugar, be boiled, and for how long?

Is the jam to be closed in tins in a hot or cold state?

The correct approximate loss of weight in manufacture of each type of jam.

What is the cause of, and what could be done to avoid, crystallisation in jams?

What is the best sugar to use for jam boiling? (South Africa.)

The quantity of sugar to be used for every 80 lb. of fruit pulp will, of course, depend on the quality of the jam to be made and the variety of pulp. For a Grade A jam the amount of sugar would be about 160 lb., whereas for a Grade B jam (lower fruit standard) 240 lb. of sugar to each 80 lb. of fruit pulp would be required, but, of course, more pectin would be needed and the output of jam would be much greater.

The temperature to which the fruit pulp is boiled does not matter, but boiling should be continued until the fruit is soft and tender. The important temperature is the final one—that is, after the sugar has been added; this varies according to the variety of jam and the barometric process. For soft fruits, the finishing temperature is usually about 223° to 224° F., whilst for hard fruit (plum, etc.), the temperature is a little lower—about 220° to 221° F.

Jams filled into tins should be as hot as possible. The tins should then be closed and inverted so as to sterilise the lid.

The loss in weight during jam boiling depends on the amount of water in the pulp and the final degree to which the jam is boiled. Generally about 30 lb. of water is lost from the finished boiling of 120 lb. of jam. For soft fruits this amount may be 35 lb.

Crystallisation in jams can be prevented by regulating the amount of invert sugar present. After boiling, the jam should be analysed for invert sugar and if the amount does not fall between the limits of 25 to 30 per cent., either the acidity or the time of boiling should be adjusted so that more or less inversion takes place.

The best sugar for jam boiling is unblued cane or beet sugar; raw sugar is unsuitable.

Potato Flour in Bread

2,045. *Any information you are able to furnish with regard to the use of Potato Flour in Bread will be appreciated.* (London.)

Potato flour is frequently used in bread in quantities of 5 lb. to the sack of flour. Such flour will carry 1½ times its weight of water and the dough produced will retain its firmness.

The bread obtained should be moist in the crumb and retain this moistness for a considerably longer period than usual. The crumb colour will be improved and the texture should be free from large holes.

When difficulty is experienced in obtaining bread with good keeping qualities, and where there is a tendency to work tight doughs, potato flour will prove a useful improver, since it ensures a thorough hydration of the gluten.

Liquid Vegetable Cream

2,046. *I have been making a liquid vegetable cream composed of nut oil, egg yolk and fresh milk, and it takes far too long in whipping up. It is homogenised at 145° F. The fat content is 42 per cent. Can you tell me what is wrong?* (Cheshire.)

In the making of a cream from nut oil, egg yolk and milk, the preliminary mixing is a very important part of the process, and unless some form of beater, such as is used by confectioners, is available, it will take a considerable time to get the oil mixed in properly. The correct method is as follows:

The egg yolk should be put into the mixer first and then the nut oil added very slowly, beating well the whole time. It is very important that there should be, at no time, a large excess of oil which is not beaten up. In this way, as the percentage of oil increases, a stiff mass resembling butter will be formed, and there should be no free oil left. The milk is then added and the beating continued. If a good emulsion is to be formed, the addition of the oil must be slow, but when mechanical beaters are used the mixing of a 20-gal. batch may be reduced to a time of about 10 minutes. With hand mixing it is much longer. The homogenising temperature and percentage of fat given are quite correct, and if the preliminary mixing is done properly there should be no difficulty.

NEW COMPANIES

Automatic Ventilating Company, Limited. (317,394.) 5, Dock Chambers, Bute Docks, Cardiff. To carry on bus. as engineers, experts in ventilation and air-conditioning, etc. Nom. Cap.: £1,000. Dirs.: To be appointed by the subs. Qual. of dirs.: £25 shares. Subs.: W. P. Richards, 68, Amesbury Road, Cardiff; A. Gibson, 75, Somerset Road, Newport, Mon.

British Coated Board and Paper Mills, Limited. (316,998.) Australia House, Strand, W.C. 2. To carry on the bus. of mnfrs. of and dlrs. in coated paper, cardboard, paper bags, boxes, etc. Nom. Cap.: £50,000. Dirs.: W. Harrison, 17, Hyde Park Terrace, W. 2 (ch.); H. T. Box, 40, Palace Road, Llandaff, Cardiff. Qual. of dirs.: £100. Remun. of dirs. (except any mng. dir.): £100 each per annum (ch. £150).

Burlington (Confectioners), Limited. (317,478.) To carry on the bus. of mnfrs. of and dlrs. in confectionery, etc. Nom. Cap.: £1,500. Dirs.: F. R. Bell, 36, Croydon Road, Reigate, Surrey; S. F. Bell, Stanhope, West Drive Gardens, Harrow Weald.

Kingsley Burton, Limited. (317792.) To take over the bus. cd. on by H. K. Burton, of Kingbur Mills, Audlem, Cheshire, and to carry on the bus. of millers, etc. Nom. Cap.: £5,000. Dirs.: H. K. Burton, Laurel Grove, Audlem, Ches. (permt. mng. dir.); J. W. Burton, Laurel Grove, Audlem, Ches.; and J. H. Major, Bath Farm, Buerton, Audlem, Ches. Qual. of mng. dir.: 2,500 shares. Other dirs.: 100 shares. Remun. of dirs.: As voted by the company.

W. Caton and Sons, Limited. (317,603.) 74, Meadow Street, Preston, Lancs. To carry on the bus. of brewers, maltsters, etc., and to take over the bus. cd. on at the Army and Navy Hotel, Meadow Street, Preston. Nom. Cap.: £1,000. Dirs.: W. Caton, 74, Meadow Street, Preston (permt. mng. dir.); W. H. Caton, 187, Deepdale Road, Preston; Mrs. B. J. Caton, 74, Meadow Street, Preston; F. Caton, 74, Meadow Street, Preston.

Central Pie Company, Limited. (316,672.) 33, Great Charles Street, Birmingham. To carry on the bus. of wholesale pie mnfrs., etc. Nom. Cap.: £200. Dirs.: B. S. Hobbs, 20, Princes Road, Tividale, near Tipton, Staffs; E. Griffiths, 4, Beacon Street, Cinder Hill, near Bilston. Qual. of dirs.: Two shares.

Cogs, Limited. (317931.) To acquire the benefit of the trade mark "Cogs", and to carry on the bus. of mnfg. confectioners, etc. Nom. Cap.: £500. Permt. dirs.: G. H. Tucker, 12, Mount Beacon, Bath, and S. St. J. Rawlings, 64, Pulteney Street, Bath (ch. and mng. dir.). Qual. of dirs.: One share.

Condima (England), Limited. (317,174.) To carry on the bus. of mnfrs. of and dlrs. in marzipans, almond and other nut products, etc. Nom. Cap.: £10,000. Dirs.: A. R. Field, Fieldhead, Skircoat Green Road, Halifax; C. G. Hoyle, 48, Boulevards, Halifax; E. H. Wells, 7, Savile Royd, Halifax. Qual. of dirs.: 500 shares. Remun. of dirs.: As voted by the company.

Cream Products, Limited. (317,527.) (1a, Victoria Grove West, Stoke Newington, N. 16. To take over the bus. of mnfrs. of food products cd. on by L. Cohen and L. Hooberman at Stoke Newington, N. Nom. Cap.: £750. Dirs.: L. Cohen, 18, Finsbury Park Road, N. 4; L. Hooberman, 68, Clapton Common, E. 5.

Dr. Greenwood's Products, Limited. (317,530.) 6, Orchard Street, Preston. To take over the bus. of a health food specialist cd. on at Preston as "Dr. Greenwood's Dairy Co." Nom. Cap.: £1,000. Dirs.: S. R. P. Fisher, Ph.C., M.P.S., Wyresdale, Cop Lane, Penwortham, Preston (permt. gov. dir.); Mrs. E. E. Fisher, Wyresdale, Cop Lane, Penwortham.

John Groves and Sons, Limited. (317,362.) To carry on the bus. of brewers, maltsters, wine and spirit mchts., etc., and to enter into agreements with Groveson (Weymouth), Ltd., Wessex Hotels, Ltd., and H. J. Groves. Nom. Cap.: £500,000. Dirs.: E. C. Hunt, J.P., 63, St. Thomas Street, Weymouth; L. H. S. Groves, Clifton, Weymouth; A. E. Clayton, Launcells, Belfield Avenue, Weymouth. Qual. of dirs.: £250 shares. Remun. of dirs.: £250 each per annum (ch. £125 extra).

H.D. Proprietary, Limited. (317,379.) 50, St. Michael's Road, Coventry. To carry on the bus. of ice-cream manufacturers and vendors, etc. Nom. Cap.: £100. Dirs.: H. Dawson, 74, Hinckley Road, Leicester; Mrs. F. E. Dawson, 74, Hinckley Road, Leicester; Marjorie Fisher, 14, Bedminster Arcade, Bristol.

Hobbs, C. W., Limited. (316,798.) To take over the bus. of a baker, confectioner, etc., cd. on by C. W. Hobbs at various addresses in Kent and Surrey. Nom. Cap.: £10,000. Dirs.: C. W. Hobbs, 47, High Street, Bromley (mng. dir. and ch.); A. S. Soole, ditto. Qual. of dirs.: One ordinary share. Remun. of dirs.: £100 per annum, divided between them.

Lekfoss Health Company, Limited. (317,317.) To carry on the bus. of mnfrs. of and dlrs. in foods, cordials, beverages, etc., and to acquire the trade mark "Lekfoss". Nom. Cap.: £1,000. Dirs.: J. Chadderton, 81, Camp Street, Salford (permt. dir. and ch.); J. S. Chadderton, 83, Camp Street, Salford, 7.

Linder, J. F., and Company, Limited. (317,123.) To carry on the bus. of corn, seed, and grain mchts., etc. Nom. Cap.: £5,000. Dir.: J. F. Linder, The Bungalow, Thunder Lane, Thorpe, Norwich. Qual. of dirs.: £100 ord. shares. Sub.: W. H. Hallett, Osborne House, High Street, Lowestoft.

Lodge Farm Fruit Products, Limited. (317,364.) 1, Church Court, Old Jewry, E.C. 2. To carry on the bus. of mnfrs. of and dlrs. in mineral and aerated waters, fruit and fruit products, etc. Nom. Cap.: £1,000. Dirs.: To be appointed by the subs. Subs.: G. R. Pitts, Raycombe, 54, Olive Avenue, Leigh-on-Sea (mng. clk.); G. Warner, 143, Elibank Road, Eltham, S.E. 9 (cashier).

Palmer-Fiddler, Limited. (317,597.) To carry on the bus. of mnfg. confectioners, etc. Nom. Cap.: £1,000. Dirs.: A. Palmer - Fiddler, Berneval, Avondale Avenue, Hinchley Wood, Surrey; Mrs. B. F. Palmer-Fiddler, Berneval, Avondale Avenue, Hinchley Wood, Surrey. Qual. of dirs.: £1.

B. Pearson and Company, Limited. (317,264.) To carry on the bus. of makers of and dlrs. in preserved fruits, jams, pickles, etc. Nom. Cap.: £3,000. Dirs.: B. Pearson, 105, Cemetery Road, Leeds (permt. mng. dir.); Miss M. Spensely, 69, Woodlea Place, Leeds. Qual. of dirs.: 25 ord. shares.

Procea Products, Limited. (317,574.) Finsbury Chambers, 76, Finsbury Pavement, E.C. 2. To enter into an agreement with Procea Products, Ltd., and the liquidator thereof, and to carry on the bus. of mnfrs. of and dlrs. in bread, flour, biscuits, confectionery, bread-making materials, etc. Nom. Cap.: £60,000. Dirs.: W. J. Bellingham, 147, Courtfield Gardens, S.W. 5; C. J. Wray, 8, Westminster Palace Gardens, S.W. 1; F. Rowlands, Formanville, Park Drive, Rustington, Sussex; D. W. Kent-Jones, West View, Castle Avenue, Dover; A. Bridges, 24, Green Park, Rathgar, Dublin.

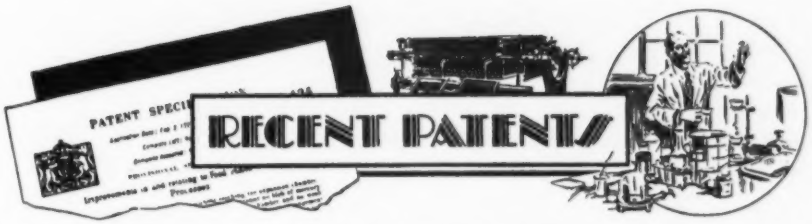
George Rennie, Limited. (317,491.) To take over the bus. of preserve mnfrs., etc., cd. on by George Rennie at Westmoreland Works, Clarence Road, Derby. Nom. Cap.: £1,500. Permt. mng. dirs.: G. Rennie, address not stated. Subs.: F. Addison, 687, Loughborough Road, Birstall, Leicester; V. O. M'Quillin, Eagle House, Friar Lane, Leicester.

Spencer, Herbert, and Sons (Caterers), Limited. (316,963.) To carry on the bus. of caterers, etc. Nom. Cap.: £10,000. Dirs.: H. Spencer, address not stated (gov. dir.); Maude E. Spencer, address not stated; H. Spencer, junr., address not stated; S. Spencer, address not stated (all permt.). Subs.: F. S. Wedlake, 17, Bedford Row, W.C. 1 (solr.); C. G. Bennett, 48, Ember Farm Way, East Molesey, Surrey (clk.).

G. Willscheid De Roost, Limited. (316,958.) 48, Neal Street, Long Acre, W.C. 2. To take over the bus. of a pork and beef butcher and sausage mnfr. cd. on at Neal Street, W.C., as "G. Willscheid de Roost". Nom. Cap.: £5,500. Permt. dirs.: G. Willscheid, 48, Neal Street, Long Acre, W.C. 2 (ch. and gov. dir.); Marie P. Willscheid, 48, Neal Street, Long Acre, W.C. Qual. of dirs.: £5 shares. Remun. of dirs.: As voted by the company.

Yorkshire Casein Manufacturers, Limited. (316,733.) 6, Brown Street, Manchester. To carry on the bus. as mnfrs. of and dlrs. in casein and milk products, etc. Nom. Cap.: £3,000. Dirs.: G. W. Widdows, Feliskirk, Castle Road, Sandal, Wakefield; P. Stevenson, 33, Lancaster Road, Birkdale, Southport; A. G. Wood, Oakfield, Barnsley. Qual. of dirs.: £100 shares.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.



These particulars of New Patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The "Official Journal of Patents" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

21675. BARTLETT, LTD., N. (KUTZSCHER): Moulds for sweetmeats, etc. August 6.
21961. TOWNSEND, C. S., and WELLESLEY HOLDINGS, LTD.: Production of predigested vegetable foodstuffs for animals. August 10.
21984. BIRNIE, F. R.: Preservation of mushrooms, etc. August 10.
22100. PEEK FREAN AND CO., LTD., RONDOLIN, L.: Edible wafer products. August 11.
22134. REICHE, K. A. M.: Frame moulds for production of chocolates, etc. August 11.
22279. PALMER, S. T.: Wrappers for chocolate blocks. August 13.
22354. BAKER PERKINS, LTD., BAKER, G. R., PATERSON, J. C.: Treatment of biscuits, etc. August 13.
22544. BURTON, J. F. H.: Manufacture of black tea. August 15.
22571. BAKER PERKINS, LTD., MACFARLANE, R. F., PRESCOTT, W. E.: Machines for icing biscuits, etc. August 17.
22851. BRAIN, C. M.: Milk-cooling means. August 19.
22876. BURNARD, A.: Preparation of food. August 19.
22985. EZAKI, S.: Manufacture of cocoa substitutes. August 20.
23054. GAUNT, J. G. (VOGT PROCESSES, INC.): Packaging of ice-cream. August 21.
23055 and 23056. GAUNT, J. G. (VOGT PROCESSES, INC.): Apparatus for forming unit portions of ice-cream. August 21.
23155. SPIEKER, E.: Manufacture of butter. August 22. (Germany, August 22, 1935.)
23215. STEVENS, A. H. (BARRON-GRAY PACKING CO.): Apparatus for mixing fruit, etc. August 24.

Complete Specifications Accepted

451,277. CAMERON, J. G.: Means for carbonating water and beverages.
451,282. SMITHFIELD AND ARGENTINE MEAT CO., LTD., and BREWSTER, J. A.: Conditioning of chilled meat in storage or transit.
451,354. ELIAS, O. A.: Manufacture of mineral water and the like.
451,374. CO-OPERATIVE WHOLESALE SOCIETY, LTD., BROCKWAY, E. J., and THOMPSON, M.: Apparatus for roasting coffee berries and the like, primarily to produce an aroma.
451,728. HUGEL, E. J.: Treatment of colloidal and/or crystalloidal solutions, in particular sugar juices.
451,751. GALLEY, F. G.: Apparatus for making infusions and decoctions.
451,811. BROOKE, N., PEEL, J. H. N., and BROOKE, BOND AND CO., LTD.: Wrappers, labels, and the like.
451,840. CHAPMAN, H. E.: Air-filtering appliances for bottles, flasks, canisters, or other vessels for containing medicinal food and like products. (Divided out of 451,839.) (February 10, 1936.)
452,161. SCHOLTES, J.: Apparatus for cutting food and delicacies. (Addition to 420,725.) (Convention date not granted.)
452,251. HIGHAM, G.: Cardboard cartons for use as containers for small foodstuffs and other small articles.
452,233. SCHWAB, DR. L.: Processes for treating cereals and grain.
452,332. ADAMS, JUN., F.: Means for wrapping butter and like foodstuffs.
452,370. SMITH, STONE, AND KNIGHT, LTD., and SMITH, T. P.: Wrapping and packing paper and like material.
452,442. WATERMAN, H. I., VLODROP, C. VAN, DIJK, J. A. VAN, and IMPERIAL CHEMICAL INDUSTRIES, LTD.: Treatment of vitamin-containing oils and products obtained therefrom.
452,483. STANDARD BRANDS, INC.: Making leavened bakery products and compositions therefor.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

449,526. **Manufacture of biscuits for therapeutic purposes.** H. C. H. GRAVES and VITAMINS, LTD., 23, Upper Mall, Hammersmith, London, W. 6.
A dry, ground material rich in vitamin B —for example, yeast, cereal germs, rice bran, or, preferably, the dried, stabilised product known as "Bemax"—is mixed with a cereal flour (white flour, wholemeal flour, rice flour) to form a homogeneous mixture; the proportions are preferably 1 : 1. Suitable quantities of water, sugar, fat, and flavouring are added, and the prepared biscuit mixture is rolled out and cooked at a controlled oven temperature not over 415° F. for not more than 21 minutes, until the biscuit is pale brown-yellow in colour, and not singed. Under these conditions the loss of vitamin B is slight; for example, a 1 : 1 mixture of white flour and Bemax, suitably prepared and cooked for 21 minutes at 415° F., yielded biscuits with 2·7 units of vitamin B per gram (76·4 units per ounce).

450,529. **Yeast or protein preparations.** C. WEIZMANN, 16, Addison Crescent, London, W. 14.
The plasmolysis of yeast is effected by adding 5 to 10 per cent. of ethyl acetate, which acts as a cell poison but is innocuous to proteolytic enzymes. After 5 to 10 minutes the plasmolysed yeast is rendered suitable for autolytic processes by adding 5 per cent. trisodium phosphate solution gradually, to keep the yeast at *p*H 6·3 to 6·6, the temperature being maintained at 35° to 36° C., under aseptic conditions (as may be obtained by a small addition, if required, of toluene). The autolysate thus obtained is claimed to possess a very high proteolytic activity. The autolysed yeast is preferably employed for the hydrolysis of other vegetable proteins—for example, soya meal or brewers' malt grains—the mixture being incubated for a requisite period and then evaporated, giving a wholesome, tasty food product.

450,693. **Preservation of green fodder.** I.G. FARBENINDUSTRIE AKT.-GES., Frankfort-on-Main, Germany.
The green fodder is preserved by moistening it in silos with dilute acid, particularly hydrochloric, sulphuric, phosphoric, and formic acids. Since the application of dilute acids would present difficulties to the farmer, these acids are preferably produced in the form of solids yielding the acids by reaction with water. Suitable materials are sodium or calcium pyrochlorsulphonate or calcium chlorsulphonate. Caking agents—*e.g.*, phosphorus pentachloride—may be added to aid in binding the powder. The addition of anhydrous oxides or salts—*e.g.*, phosphorus pentoxide—causes absorption of water and hence delays the reaction, which prevents acid fumes disturbing the workers packing the fodder. Wetting agents may also be incorporated. The fodder is laid in alternate layers with the powder, using about 10 kgm. of powder to 1,800 to 2,500 kgm. of fodder. The fodder in direct contact with the powder is not injured by over-treatment with acid, as the acid diffuses rapidly. In the case of dry fodder water may be added after packing.

450,798. **Process for preventing the infection of milk.** O. V. JENSEN, Aalholmsvej 61, Copenhagen, Denmark.
The milk is collected directly from the udder of the cow into cleansed, sterilised cans which have been filled with carbon dioxide gas. The cans, which are of a size suitable both for milking and transport, are provided with a filter in the neck and a removable lid which can be clamped down to render the can airtight. The can is preferably filled with the carbon dioxide immediately after the cleansing processes. It is intended that the dairy shall cleanse and fill the cans with the carbon dioxide; the cans are then opened only during the actual milking. The carbon dioxide provides a sterile atmosphere in the can, and thus prevents infection of the milk.

LATEST TRADE MARKS

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal", and is published by permission of the Controller of H.M. Stationery Office. The "Trade Marks Journal" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

AVALON. — 570,703. **Cheese.** KRAFT CHEESE COMPANY, LTD., Silverdale Road, Hayes, Middlesex. September 2.

CACTI BRAND. — 569,200. **Cheese.**

PIETER VAN WOERDEN, CORNELIS BERNARDUS VAN WOERDEN, and MARTYNTJE BRUGGEMAN, trading as C. B. van Woerden and Zonen, Stationsweg 31-33, Akkrum, Holland. September 2.

Cheese and goods of a like kind to cheese will be struck out from the goods of Registration No. 235,625 (1198) if and before the applicants' mark is registered.

COLLARO.—569,670. **Beverages, not alcoholic, not medicated, and not aerated.** COLLARD AND CARLING, LTD., 5, High Street, Whitstable, Kent. August 26. (Associated.)

DEWPAT. — 569,960. **Edible oils and edible fats.** THE BRITISH CREAMERIES, LTD., 1, Watergate, Tudor Street, London, E.C. 4. September 2.

FLORO.—570,017. **Edible oils and edible fats.** THOMAS HEDLEY AND CO., LTD., Phœnix Buildings, Collingwood Street, Newcastle-on-Tyne. September 9.

GOLD-CLUST. — 566,837. **Fresh fruit.** WILLIAM MINTO MIRRLEES, 35, Meadway, Wavertree, Liverpool, 15. August 26.

GOLDEN RING.—566,772. **Pickles, jams, marmalades, sauces, chutneys, coffee essences, coffee extracts, jellies (for food), and beverages (not alcoholic, not medicated).**

THE RIVER PRESERVING CO., LTD., Golden Ring Works, Rosebery Avenue, Tottenham, London, N. 17. August 26. (Associated.) (By Consent.)

The trade mark is limited as regards the ring device to the colour gold, as shown in the representation on the form of application.

GRAND DUKE. — 569,453. **Caviare.** COOPER AND CO.'S STORES, LTD., 8 to 38, Howard Street, Glasgow, and 2 to 16, Church Street, Liverpool. August 19.

HONEYTEX.—570,495. **Bread and cakes, all made of or containing honey.** R. STRAWBRIDGE, LTD., 23, Green Lanes, Palmer's Green, London, N. 13. September 9.

H. F. G. HOOKE. — 568,640. **Apples.**

HAROLD FRANCIS GEORGE HOOKE, Farthings, Arley, near Bewdley, Worcester. August 26.

Registration of this trade mark shall give no right to the exclusive use of the device of an apple.

MERIDAN.—569,905. **Dried fruits, nuts for food, and dates.** BARROW, LANE, AND BALLARD, LTD., Pudding Lane, London, E.C. 3. August 19.

MOISTEXA. — 569,821. **A preparation, being an ingredient in food used in connection with the bakery and confectionery trades.** CHOCROLL, LTD., 55, Quadrant Road, Thornton Heath, Surrey. August 26.

OVALTINEY.—569,116. **Substances used as food or as ingredients in food.** A. WANDER, LTD., 184, Queen's Gate, London, S.W. 7. September 2. (Associated.)

PARAGON.—B 566,707. **Peas for food.**

JOHN MORRELL AND CO., LTD., 57, Victoria Street, Liverpool. September 9.

User claimed from August 10, 1933.

The trade mark is limited to the colours yellow, green, white, and black, as shown in the representation on the form of application.

The applicants undertake that this mark, when registered, and the marks Nos. 260,723 (1364), 331,080 (1731), 535,126 (2852), and B 545,329 (2922), and any other marks associated therewith shall be assigned or transmitted only as a whole and not separately.

REX.—568,943. **Yeast for food.** BRITISH FERMENTATION PRODUCTS, LTD., Chieftain Works, Putney Bridge Road, London, S.W. 15. September 2.

SUGAR-MILL.—569,870. **Sugar and molasses.**

THE BARBADOS SUGAR CO., LTD., 38, Lombard Street, London, E.C. 3. August 19. (By Consent.)

Registration of this trade mark shall give no right to the exclusive use, either separately or in combination, of the word "Sugar-mill" and the device of sugar canes.

SPOLJU.—569,693. **Olive oil, for use as food, malt extract with olive oil (for food) and emulsions of olive oil and orange juice (for food).** THOMAS EDWARD HUGHES and ERNEST MICHAEL MURPHY, trading as E. M. Murphy and Co., 74a, Seel Street, Liverpool. August 19.

SUNFED.—569,680. **Milk, butter, cream, cheese, and condensed milk.** CLOVER DAIRIES, LTD., New England Siding, Cressey Street, Grimsby, Lincolnshire. September 9.

SUNNYBAIRN.—569,936. **Biscuits.** BEE BEE BISCUITS, LTD., Sunya House, Cumberland Park, Willesden, London, N.W. 10. September 2. (Associated.)

VELCOVA.—569,695. **Biscuits and cakes.** CO-OPERATIVE WHOLESALE SOCIETY, LTD., 1, Balloon Street, Manchester. September 2. (By Consent.)

WALBI.—570,184. **Watercress for food.** WALTER BIGGS and CYRIL ROY BIGGS, trading as Walter Biggs and Son, Willowdale, Bullington, Sutton Scotney, Hampshire.

ZINTZ. — 570,654. **Substances used as food or as ingredients in food.** F. W. HAMPSHIRE AND CO., LTD., Sunnydale Works, Sinfin Lane, Derby. September 9. (Associated.)

567,416.—**Flavoured barley water (not alcoholic, not aerated, and not medicated) and flavoured barley crystals for making beverages.**

KEEN ROBINSON AND CO., LTD., Carrow Works, Norwich. September 9. (Associated.)

569,832.—**Substances used as food or as ingredients in food.**

KENNETH DOUGLAS BRIGGS, Robin's End, Eastham, Tenbury, Worcestershire. August 19.

Registration of this trade mark shall give no right to the exclusive use of the devices of fruit.

570,352.—**Beverages (not alcoholic, not medicated, and not aerated).**

JOSEPH HOBSON AND SON, LTD., Dantzic Brewery, Regent Street, Leeds. September 9. (Associated.)

The applicants undertake not to use the cross device in red or in white on a red ground, or in any similar colour or colours.